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Provision, uptake and cost of cardiac rehabilitation programmes: improving services to under-represented groups

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Abstract

Provision, uptake and cost of cardiac rehabilitation programmes: improving services to under-represented groups

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Objectives: To estimate UK need for outpatient cardiac rehabilitation, current provision and identification of patient groups not receiving services. To conduct a systematic review of literature on methods to improve uptake and adherence to cardiac rehabilitation. To estimate cost implications of increasing uptake of cardiac rehabilitation.
Data sources: Hospital Episode Statistics (England). Hospital Inpatient Systems (Northern Ireland). Patients Episode Database for Wales. British Association for Cardiac Rehabilitation/British Heart Foundation surveys. Cardiac rehabilitation centres. Patients from general hospitals. Electronic databases.
Review methods: The study analysed hospital discharge statistics to ascertain the population need for outpatient cardiac rehabilitation in the UK. Surveys of cardiac rehabilitation programmes were conducted to determine UK provision, uptake and audit activity, and to identify local interventions to improve uptake. Data were also examined from a trial estimating eligibility for cardiac rehabilitation and non-attendance. A systematic review of interventions to improve patient uptake, adherence and professional compliance in cardiac rehabilitation was conducted. Estimated costs of improving uptake were identified from national survey, systematic review and sampled cardiac rehabilitation programmes.
Results: In England, Wales and Northern Ireland nearly 146,000 patients discharged from hospital with primary diagnosis of acute myocardial infarction, unstable angina or following revascularisation were potentially eligible for cardiac rehabilitation. In England in 2000, 45–67% of these patients were referred, with 27–41% attending outpatient cardiac rehabilitation. If all discharge diagnoses of ischaemic heart disease were considered, nearly 299,000 patients would be potentially eligible and in England rates of attendance and referral would be 22–33% and 13–20% respectively. Rates of referral and attendance were similar in Wales, but somewhat lower in Northern Ireland. It was found that referral and attendance of older people and women at cardiac rehabilitation tended to be low. It was also suggested that patients from ethnic minorities and those with angina or heart failure were less likely to be referred to or join programmes. A wide range of local interventions suggested awareness of the problem of uptake. In an NHS-funded randomised controlled trial, possibly representing more optimal protocol-led care, medical and nursing staff identified 73–81% of patients with acute myocardial infarction as eligible for cardiac rehabilitation. Excluded patients tended to be older with more severe presentation of cardiac disease. Experiences of patients suggested that uptake may be improved by addressing issues of motivation and relevance of rehabilitation to future well-being, co-morbidities, site and time of programme, transport and care for dependants. Systematic review of studies supported the use of letters, pamphlets or home visits to motivate patients and the use of trained lay visitors. Self-management techniques showed some value in promoting adherence to lifestyle changes. Studies examining professional compliance found that professional support for practice nurses may have value in the coordination of postdischarge care. Average costs in 2001 of cardiac rehabilitation to the health

service per patient completing a cardiac rehabilitation programme were about £350 (staff only) and £490 (total). If services were modelled on an intermediate multidisciplinary configuration with three to five key staff, approximately 13% more patients could be treated with the same budget. Depending on staffing configuration an approximate 200–790% budget increase would be required to provide cardiac rehabilitation to all potentially eligible patients.
Conclusions: Provision of outpatient cardiac rehabilitation in the UK is low and little is known about the capacity of cardiac rehabilitation centres to increase this provision. There is an uncoordinated approach to audit data collection and few interventions aimed at improving the situation have been formally evaluated. Motivational communications and trained lay volunteers may improve uptake of cardiac rehabilitation, as may self-management techniques. Experience of low-cost interventions and good practice exists within rehabilitation centres, although cost information frequently is not reported. Increased provision of outpatient cardiac rehabilitation will require extra resources. Further trials are required to compare the cost-effectiveness of comprehensive multidisciplinary rehabilitation with simpler outpatient programmes, also research is needed into economic and patient preference studies of the effects of different methods of using increased funding for cardiac rehabilitation. An evaluation of a range of interventions to promote attendance in all patients and under-represented groups would also be useful. The development of standards is suggested for audit methods and for eligibility criteria, as well as regular and comprehensive data collection to estimate the need for and provision of cardiac rehabilitation. Further areas for intervention could be identified through qualitative studies, and the extension of low-cost interventions and good practice within rehabilitation centres. Regularly updated systematic reviews of relevant literature would also be useful.

Contents

List of abbreviations

AMI	acute myocardial infarction
BACR	British Association for Cardiac Rehabilitation
BHF	British Heart Foundation
CABG	coronary artery bypass graft
CHD	coronary heart disease
CI	confidence interval
CR	cardiac rehabilitation
HES	Hospital Episode Statistics (England)
HF	heart failure
HIS	Hospital Inpatient Systems (Northern Ireland)
ICD-10	International Classification of Diseases-10
IHD	ischaemic heart disease
IQR	interquartile range
MI	myocardial infarction
NSF-CHD	National Service Framework for Coronary Heart Disease
OR	odds ratio
PEDW	Patient Episode Database for Wales
PTCA	percutaneous transluminal coronary angioplasty
QUOROM	quality of reporting of meta-analyses
RCT	randomised controlled trial
RR	relative risk
SD	standard deviation
UA	unstable angina
VAT	value added tax

All abbreviations that have been used in this report are listed here unless the abbreviation is well known (e.g. NHS), or it has been used only once, or it is a non-standard abbreviation used only in figures/tables/appendices in which case the abbreviation is defined in the figure legend or at the end of the table.

Executive summary

Background

The National Service Framework for Coronary Heart Disease (NSF-CHD) identifies patients with acute myocardial infarction and following coronary revascularisation as eligible for outpatient cardiac rehabilitation. However, rehabilitation uptake remains low, particularly in some specific patient groups. While many barriers to patient participation have been described, the effectiveness of interventions to improve uptake and adherence has not been assessed by systematic review. Furthermore, the cost implications of interventions to improve uptake and adherence and of increasing overall provision to meet total population need have not been estimated.

Objectives

- To estimate UK population need and update estimates of cardiac rehabilitation provision.
- To identify patient groups not receiving cardiac rehabilitation.
- To review effectiveness of methods to improve uptake and adherence to cardiac rehabilitation.
- To estimate cost implications of increasing uptake of cardiac rehabilitation.

Methods

- Analysis of hospital discharge statistics to ascertain the population need for outpatient cardiac rehabilitation in the UK.
- Surveys of cardiac rehabilitation programmes to determine UK provision, uptake and audit activity, and to identify local interventions to improve uptake. Estimation of eligibility for cardiac rehabilitation and non-attendance in a recent trial.
- Systematic review of interventions to improve patient uptake, adherence and professional compliance in cardiac rehabilitation.
- Assessment of costs of improving uptake identified from national survey, systematic review and sampled cardiac rehabilitation programmes.

Results

Population need and provision

In England, Wales and Northern Ireland nearly 146,000 patients discharged from hospital with a primary diagnosis of acute myocardial infarction, unstable angina or following revascularisation were potentially eligible for cardiac rehabilitation. In England in 2000, 45–67% of these patients were referred, with 27–41% attending outpatient cardiac rehabilitation. If all discharge diagnoses of ischaemic heart disease (including angina pectoris and heart failure) were considered, nearly 299,000 patients would be potentially eligible, with rates of referral and attendance of 22–33% and 13–20%, respectively. Rates of referral and attendance were similar in Wales, but somewhat lower in Northern Ireland.

Patient uptake

Referral and attendance of older people and women at cardiac rehabilitation tended to be low. There was a suggestion that patients from ethnic minorities and those with angina or heart failure were less likely to be referred to or join programmes. A wide range of local interventions suggested awareness of the problem of uptake.

The survey of cardiac rehabilitation centres in England identified an uncoordinated approach to audit, with variations in methods and content despite guidelines and the NSF requirements.

In an NHS-funded, multicentre, randomised controlled trial, possibly representing more optimal protocol-led care, medical and nursing staff identified 73–81% of patients with acute myocardial infarction as eligible for cardiac rehabilitation. Excluded patients tended to be older with more severe presentation of cardiac disease. Experiences of patients suggested that uptake may be improved by addressing issues of motivation and relevance of rehabilitation to future well-being, co-morbidities, site and time of programme, transport and care for dependants.

Systematic review

A comprehensive search strategy identified studies relating to uptake, adherence or professional compliance with cardiac rehabilitation. Of 3261 references identified, 957 were acquired as potentially relevant. Reports were frequently not published in easily accessible form. The majority of studies were small, of short duration and not of high quality. Consequently, none of the findings

can be considered definitive. Few studies reported cost implications.

Eight studies (three randomised) evaluated methods to improve patient uptake of cardiac rehabilitation. These supported the use of letters, pamphlets or home visits to motivate patients. Some encouragement was found for the use of trained lay visitors. Fourteen studies (seven randomised) evaluated methods to improve overall patient attendance or maintenance of lifestyle changes associated with cardiac rehabilitation. Self-management techniques showed some value in promoting adherence to lifestyle changes. Six studies (two randomised) evaluated methods to improve patient uptake and adherence to cardiac rehabilitation by improving professional compliance with guidelines and good practice. Although no effective interventions specifically aimed at improving professional compliance were found, professional support for practice nurses may have value in the coordination of postdischarge care.

Healthcare costs

Average costs in 2001 of cardiac rehabilitation to the health service per patient completing a cardiac rehabilitation programme were about £350 (staff only) and £490 (total). It is estimated that outpatient cardiac rehabilitation represented an NHS cost of £15–24 million in the UK. Variation in cost per patient across centres was partly explained by the duration of rehabilitation and staff-to-patient ratio. If services were modelled on an intermediate multidisciplinary configuration with three to five key staff, approximately 13% more patients could be treated with the same budget. If the most modest services were provided, 40% more patients could be treated. Depending on staffing configuration an approximate 200–790% budget increase would be required to provide cardiac rehabilitation to all potentially eligible patients.

Conclusions

Implications for healthcare

- Provision of outpatient cardiac rehabilitation in the UK is low, well below the NSF-CHD goal of 85% of patients with acute myocardial infarction and following revascularisation being offered outpatient cardiac rehabilitation.
- Information on referral to and uptake of cardiac rehabilitation is incomplete, with widely varying estimates of provision, particularly in under-represented groups. Little is known about the capacity of cardiac rehabilitation centres to increase provision.
- There is an uncoordinated approach to audit data collection.
- Reasons reported by patients for non-attendance are amenable to intervention, but few interventions have been formally evaluated.
- Many interventions aimed at improving patient uptake, adherence and professional compliance with guidelines and good practice have been proposed, but few have been formally evaluated.
- Motivational communications and trained lay volunteers may improve uptake of cardiac rehabilitation.
- Self-management techniques may help to promote lifestyle change associated with cardiac rehabilitation.
- Information on costs of interventions is frequently not reported.
- Experience of low-cost interventions and good practice exists within rehabilitation centres.
- Increased provision of outpatient cardiac rehabilitation will require extra resources.

Recommendations for research and development

- Trials comparing the cost-effectiveness of comprehensive multidisciplinary rehabilitation with simpler outpatient programmes.
- Economic and patient preference studies of the effects of different methods of using increased funding for cardiac rehabilitation, and evaluations of the impact of any increased funding.
- Evaluation of a range of interventions (including self-management techniques, motivational communication and the use of trained lay volunteers) to promote attendance in all patients and under-represented groups.
- Development of standardised audit methods in the context of modern records systems, appropriate training for dedicated staff and dialogue between service contributors. Standardisation of criteria for patient eligibility, regular and comprehensive data collection to estimate the need for and provision of cardiac rehabilitation.
- Identification of further areas for intervention through qualitative studies.
- Extension of low-cost interventions and good practice within rehabilitation centres.
- Regular updated systematic review of literature relating to uptake and adherence to cardiac rehabilitation to include ‘grey’ literature and non-UK studies.

Chapter 1
Background

Cardiac rehabilitation

Comprehensive cardiac rehabilitation offers patients with coronary heart disease a long-term programme involving medical evaluation, 'prescribed' exercise, cardiac risk factor modification, education and counselling.[1] In partnership with a multidisciplinary team of health professionals, patients with cardiac disease are encouraged and supported to achieve and maintain optimal physical and psychosocial health.[2]

In the UK cardiac rehabilitation usually comprises four phases[3] in which the themes of exercise, education, psychological support and counselling are addressed to a level appropriate to the stage of recovery. Throughout, consideration is given to the processes of explanation and understanding,[4] and the overall aim of long-term maintenance of a healthy lifestyle.

The first phase takes the form of counselling with a simple programme of education and psychological support while in hospital.[5] Physical, psychological and social needs for cardiac rehabilitation are assessed and advice is given on everyday activities with encouragement to take light exercise in the first few weeks at home, the second phase of rehabilitation. Home visiting and telephone contact, and the use of educational materials or a supervised self-help programme, provide support during this period. The third phase of rehabilitation is delivered in an outpatient setting by appropriate health professionals and lasts typically for 6–8 weeks. Key programme elements are supervised exercise, education on secondary prevention and risk factor modification, and psychological approaches to recovery. Maintenance of healthy behaviours after completion of the outpatient programme is the fourth phase of cardiac rehabilitation. Continued exercise and adherence with lifestyle changes may be mediated through a cardiac support group.

Effectiveness in patients with coronary heart disease

The effectiveness of cardiac rehabilitation has been the subject of several randomised trials and reviews.[6–9] Most recently, a Cochrane systematic review concluded that exercise-based cardiac rehabilitation is effective in reducing cardiac deaths, cardiovascular morbidity and primary risk factors in patients who have had myocardial infarction.[10] An earlier overview of the evidence conducted by the NHS Centre for Reviews and Dissemination stated that a combination of exercise, psychological and educational interventions is the most effective form of cardiac rehabilitation,[11] but the efficacy of combinations and durations of different components of the rehabilitation package remains uncertain. In England, the National Service Framework for Coronary Heart Disease (NSF-CHD) concluded that there is scope for improving services so that all those in need are offered rehabilitation.[12]

Evidence for the effectiveness of cardiac rehabilitation mainly derives from studies of patients with myocardial infarction and there are insufficient data to stratify systematic reviews by indication.[10] However, the inclusion in reviewed trials of patients who have undergone revascularisation, that is, coronary artery bypass graft (CABG) or percutaneous transluminal coronary angioplasty (PTCA), or who have had angina pectoris or coronary artery disease defined by angiography suggests the possibility of benefit for these groups. Furthermore, while there is no conclusive evidence that cardiac rehabilitation reduces mortality in patients with heart failure, a recent systematic review looking specifically at exercise interventions found physiological benefits and positive effects on quality of life in selected subgroups.[13]

Guidelines recommend that outpatient cardiac rehabilitation should be available for patients following myocardial infarction, PTCA and CABG, and for patients with angina, heart failure[14] and arrhythmia.[15,16] The Fifth Report on the Provision of Services for Patients with Coronary Heart Disease states that in the UK patients must have access to rehabilitation when required, for example after a heart attack, cardiac surgery and intervention.[17] In England the NSF-CHD identifies patients who have survived acute myocardial infarction and those who have

undergone CABG or PTCA as priorities for cardiac rehabilitation.[12] When high-quality-cardiac rehabilitation is available to these patients the NSF-CHD recommends that services should be extended to patients with angina and heart failure. In Wales, cardiac rehabilitation should be provided for all those who have had an episode of acute coronary syndrome, some of whom will have undergone a revascularisation procedure.[18] The Canadian Association for Cardiac Rehabilitation states that cardiac rehabilitation should be considered standard, usual care for virtually all patients with documented cardiovascular disease.[19]

Effectiveness in specific patient groups

Evidence for the effectiveness of cardiac rehabilitation in older and female patients is limited, as participants in trials tend to be younger and predominantly male. In the most recent systematic review the mean age of patients in exercise only studies was 53 years (range of means 50–70 years) and in trials of comprehensive cardiac rehabilitation 56 years (range of means 47–63 years).[10] Women comprised 4% of patients in exercise-only and 11% of patients in comprehensive cardiac rehabilitation trials. Trials show a bias towards the inclusion of men and most excluded older people. However, systematic reviews provide no evidence to suggest that elderly or female patients benefit less than younger or male patients.[10] Indeed, it is possible that the patients who would benefit most from cardiac rehabilitation are those excluded from trials on the grounds of age, gender or co-morbidity.[20]

In elderly patients the goals of cardiac rehabilitation may differ from those of younger patients, and include the preservation of mobility, self-sufficiency and mental function.[21] Cardiac rehabilitation may represent an opportunity to provide effective healthcare and achieve a high quality of life for older patients.[22] Similarly, the frequently lower level of fitness observed in women at the time of hospitalisation suggests a greater potential for health improvement with cardiac rehabilitation.[23,24]

In trials of cardiac rehabilitation the ethnic background of patients is seldom reported,[10] but it is likely that trial participants are mainly white Caucasian. There is neither evidence nor a mechanism to suggest lack of benefit in ethnic minority groups.[11]

Thus, evidence from randomised controlled trials (RCTs), as demonstrated in *Figure 1*, supports the effectiveness of cardiac rehabilitation in a range of cardiac diagnoses including post-myocardial infarction, post-PTCA, post-CABG, angina pectoris and heart failure. To date, although patients with different cardiac conditions, and female, elderly and non-white Caucasian ethnic groups, have been poorly represented in trials of cardiac rehabilitation there is no evidence to suggest that outcomes are less favourable.

Uptake of cardiac rehabilitation

Although it is considered effective in quickening recovery and improving prognosis, not all patients participate in a cardiac rehabilitation programme. Several recent UK surveys have reported the uptake of cardiac rehabilitation by patients with a discharge diagnosis of coronary heart disease.[25–29] These are summarised in *Table 1*.

Surveys in the UK show low levels of patient participation (14–43% after myocardial infarction) with similarly low attendance reported in Australia,[30] France,[31] New Zealand[32] and the USA.[33–35] Low patient participation is a consequence of low levels of provision, referral and invitation, and of poor uptake by patients.

Under-representation in cardiac rehabilitation

Patients participating in cardiac rehabilitation programmes have tended to be male, middle-aged and diagnosed with uncomplicated myocardial infarction.[36] Those who do not participate in a programme often have greater degrees of functional impairment and are the patients most in need of and most likely to benefit from rehabilitation.[20]

Variation in referral rates for patients with different cardiac diagnoses reflects the traditional indication for cardiac rehabilitation services of myocardial infarction and CABG.[37] CABG patients tend to be younger than those with myocardial infarction and this may explain some of the increased rehabilitation uptake seen after CABG (see *Table 1*).[26] Patients admitted for PTCA are less likely to be invited or participate, probably as a consequence of the short hospital stay and the limited opportunities for recruitment. Also, the procedure is less invasive and painful than CABG, with a quicker recovery and return to work and

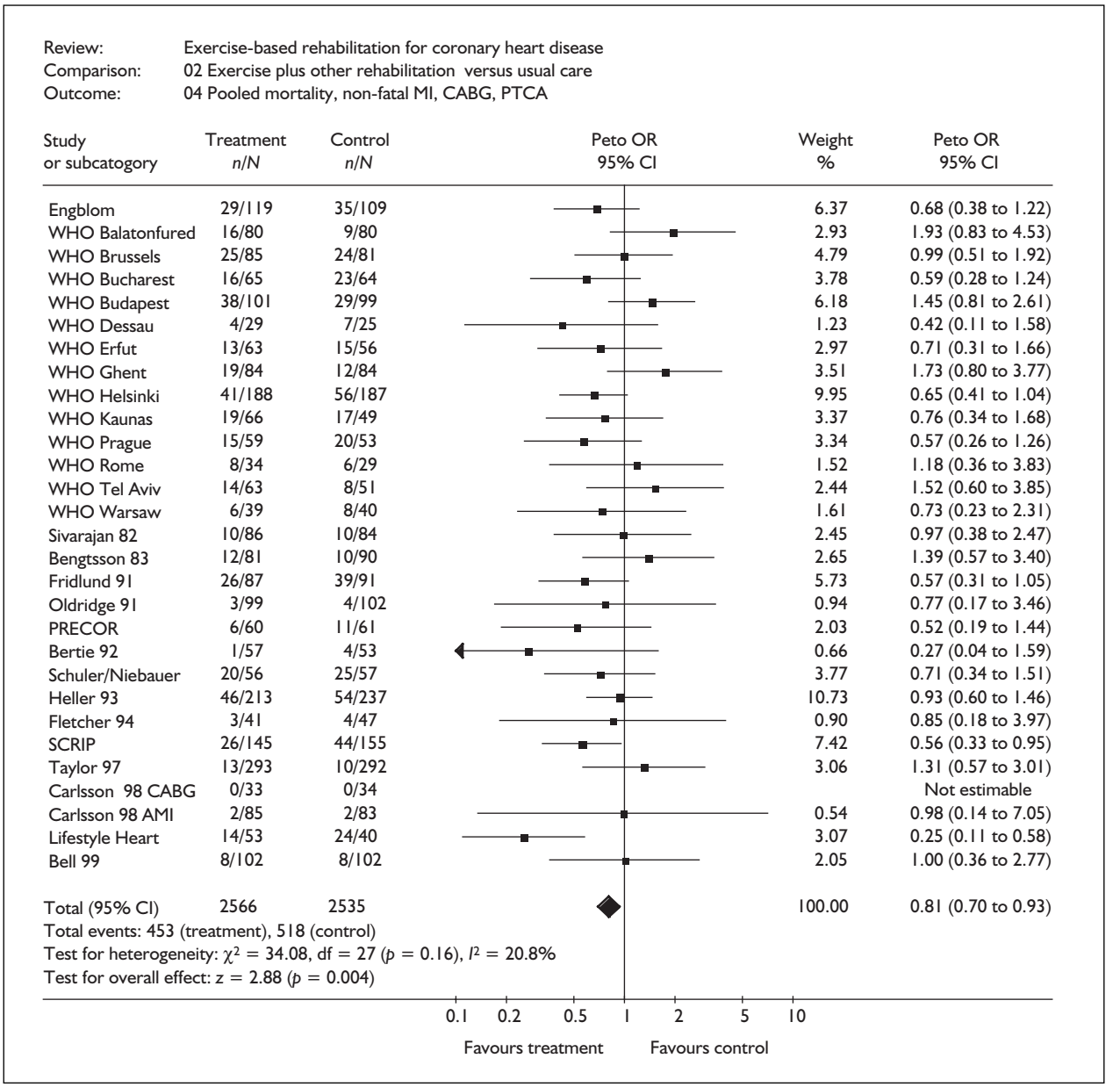

FIGURE 1 *RCTs of the effects of cardiac rehabilitation. Source: Jolliffe* et al.*, 2002[10] with permission of The Cochrane Library. CI, confidence interval; MI, myocardial infarction; OR, odds ratios; WHO, World Health Organization.*

normal activities.[38,39] Heart failure patients are less likely to be referred for cardiac rehabilitation than other cardiac patients[40] and the complexity of the medical condition is identified as a barrier to physician referral.[41] In the UK few programmes recruit heart failure patients, possibly reflecting the perceived need for further evaluation of effectiveness and safety in this patient group.[42] In England, provision for both heart failure and angina may be limited by the priorities identified in the NSF-CHD: "once Trusts have an effective system recruiting people who have survived a myocardial infarction or who have undergone coronary revascularisation to high quality cardiac rehabilitation, they should extend their rehabilitation services to people admitted to hospital with other manifestations of coronary heart disease, e.g. angina and heart failure."[12]

Patients with chronic non-cardiac medical disorders may be excluded from cardiac rehabilitation.[43] Medical reasons for non-invitation include impaired mobility, more severe angina and peripheral arterial disease,[29] chronic obstructive pulmonary disease and asthma,[39] arthritis and back problems,[44] and alcohol addiction.[45]

TABLE 1 *Uptake of cardiac rehabilitation in recent UK surveys*

Author	Year of survey	Region	Study design	Total no. of eligible patients	Participation as percentage of eligible patients
Evans *et al.*, 2002[25]	2000	UK	CR programme survey compared with BHF statistics	208,080 total (calculated from percentages)	17% MI 44% CABG 6% PTCA
Bethell *et al.*, 2001[26]	1997	UK	CR programme survey compared with BHF statistics	150,000 total	14–23% MI 33–56% CABG 6–10% PTCA
Melville *et al.*, 1999[27]	1996	Nottingham	CR enrolment lists compared with hospital discharge	261	43% MI
Campbell *et al.*, 1996[28]	1994	Scotland	CR programme survey compared with CHD survival	29,294 (calculated from 4980 = 17% of total)	17% CHD
Pell *et al.*, 1996[29]	1994	Glasgow	CR department lists compared with hospital discharge	887	21% MI (12% completed)

BHF, British Heart Foundation; CHD, coronary heart disease; CR, cardiac rehabilitation.

Rehospitalisation, health deterioration and placement in a nursing home are also associated with reduced participation in cardiac rehabilitation.[46] Patients with communication difficulties including short-term memory loss and confusion, poor cognitive functioning or neurological impairment may be less likely to participate in cardiac rehabilitation,[39,46–48] and a greater dropout rate has been observed in patients with symptoms of depression.[49]

Older patients may not receive the same amount of advice from physicians on cardiac risk reduction as younger patients.[46] Invitation to cardiac rehabilitation is often lower in older patients.[3,29,32,33,39,41,43,46,49–52] In a US survey older patients expressed a preference for home-based programmes, whereas younger patients preferred comprehensive clinic-based programmes.[53]

Women tend to be under-represented in cardiac rehabilitation.[20,32,33,43,54] Referral rates may be lower,[33,43] possibly reflecting the increased age of women presenting with cardiovascular disease[55] and the presence of co-morbid conditions.[20] Women may be reluctant to participate in formal cardiac rehabilitation[56] and perceived as less motivated to attend structured programmes with strenuous exercise.[23] However, rehabilitation professionals may seem less helpful and less encouraging in promoting cardiac rehabilitation for women.[57] Invitation to a predominantly male exercise group may also serve to discourage participation by women.[57]

Participation rates of patients living in areas of high social deprivation are low, probably reflecting reduced uptake rather than referral.[27,29,58,59] Patients with no paid employment may also be less likely to attend a cardiac rehabilitation programme.[59]

In a survey of Canadian cardiac rehabilitation programmes participation by non-English-speaking patients was seen to be considerably lower than by English-speaking patients.[39] No similar surveys have been published in the UK, but a retrospective hospital audit found low attendance at cardiac rehabilitation among patients of South Asian origin.[60] This was attributed to poor access and inadequate use of interpreting services by patients and staff, and lack of translated written information.

Barriers to uptake and adherence

Cardiac rehabilitation should be accessible and acceptable to patients. A balance must be achieved between a programme of sufficient intensity and duration to be effective, and the tendency of a long programme to encourage dependence in some and dropout in others.[61] Many patients

make recommended lifestyle changes, but others make no change or find it difficult to maintain new behaviours.[62] The initial improvements in exercise tolerance and psychosocial well-being observed in some trials are not evident over the longer term and this has been attributed to reductions in compliance.[63] Patients and providers have identified numerous possible reasons for low levels of uptake, adherence and professional compliance with cardiac rehabilitation.[64]

Some patients show a lack of interest and are reluctant to change their lifestyle.[14,41,46,59,65,66] Affective reactions to disease can lead to maladaptive responses and fear.[44,66,67] The patient may not perceive that they will benefit from participating in a programme or may receive contradictory advice from other sources.[41,51,68,69] Conversely, after a short period of rehabilitation patients may be satisfied and choose to continue independently.[70] Patients may dislike classes or the hospital setting.[34,51]

Patterns of personal or family living can influence participation in cardiac rehabilitation.[71] Conflicting work or domestic commitments and time conflicts are associated with reduced attendance at cardiac rehabilitation.[24,51,66,70] Lack of family support may be a barrier to uptake of cardiac rehabilitation services.[44,66]

In the USA, reimbursement issues and cost of rehabilitation services limit attendance at cardiac rehabilitation.[14,34] Patients with insurance coverage for cardiac rehabilitation are more likely to be referred and programme directors identify financial issues as the major barrier for rehabilitation uptake.[37] Fee-for-service patients are more likely to receive cardiac rehabilitation than health maintenance organisation patients.[72] A requirement for continuous ECG monitoring during exercise sessions, physician evaluation of traces and exercise prescription also limits rehabilitation provision.[73]

Cardiologists may be more likely to refer patients to cardiac rehabilitation than primary care physicians.[14,29,50,66] Differing rates of referral may reflect professional scepticism or a poor knowledge base about the effectiveness of cardiac rehabilitation[39,46,62] and it is possible that physicians recommend rehabilitation to younger patients or those expected to comply.[46,74] The source of referral may also influence patient attendance at cardiac rehabilitation, with physician referral and in particular that of a cardiologist shown to improve uptake.[29,39,40,75]

The location, convenience and accessibility of a cardiac rehabilitation programme influence attendance.[14,34,41,43,66,76] Patients living closer to the programme are more likely to receive a referral and attend.[37,52,65] Patients living in cities or urban areas are more likely to attend cardiac rehabilitation.[39,77] Inconvenient transportation, lack of and cost of transport, and parking problems are frequently cited as barriers to attendance at cardiac rehabilitation.[34,51,70]

Barriers to uptake and adherence may be summarised as follows.

Patient factors:
- lack of interest
- reluctance to change lifestyle
- depression
- dislike of classes/hospitals
- work or domestic commitments
- lack of family support
- rural residence.

Service factors:
- cost and reimbursement
- ECG monitoring requirement
- location and accessibility
- car parking

Professional factors:
- knowledge and attitudes
- referral
- prejudice (age, race, gender).

Economic aspects of cardiac rehabilitation

Costs of cardiac rehabilitation services vary by format of delivery. The German approach to cardiac rehabilitation with 4–6 weeks of inpatient care is estimated to cost about seven times that of an outpatient service.[78] Information on the direct costs of outpatient cardiac rehabilitation as provided in the UK is limited. The results of recent UK costs studies[25,79–82] are shown in *Table 2*.

Comparison of studies is difficult as the authors used different methodologies and sources of cost estimates. The most recent BACR/BHF survey suggests that cost varies widely, with a range of £50–712 per patient treated depending on the level of staffing, the equipment used and the intensity of the programme.[25] Staffing represents the most important share, with estimates of 64–80% of total direct costs.[79,81]

TABLE 2 *Studies reporting costs of cardiac rehabilitation in the UK*

Author	Year	Type of programme	Costs considered	Results
Evans *et al.*, 2002[25]	2000	Annual BACR/BHF survey: budget statements from 37 centres	Staff costs, possibly some allowances for stationery	£50–712 per patient (median £256) (2000 prices)
Osika, 2001[82]	1997/98	Based on four cardiac rehabilitation centres in Gwent	Staff costs, non-staff costs (not specified)	£292 per patient, range £250–375 (1997–98 prices)
Taylor and Kirby, 1999[81]	1995	One UK centre with 12-week programme with two outpatient visits	Staff costs, equipment costs, capital costs, transport	£140 per patient £6 per patient per session (1995 prices)
Gray *et al.*, 1997[80]	1994	Survey of 16 UK centres with an average of 9.2 sessions per patient (10.2 hours per patient)	Staff costs	£371 per patient (median £223), £47 per patient per session (median £26) (1994 prices)
Turner, 1993[79]	1992	Based on ten cardiac rehabilitation programmes in the Wessex region	Staff costs, overhead costs, equipment costs, capital costs	£200 per patient (1992 prices)

BACR, British Association for Cardiac Rehabilitation.

Little information is available on the costs of establishing or expanding a rehabilitation service. Previously, it was considered that the resources needed to establish a cardiac rehabilitation programme were present in most district hospitals.[3,83] With changes in healthcare management and increasing demands on facilities and space this may not now be the case.

Conclusions

Outpatient cardiac rehabilitation should be available to patients with a range of cardiovascular diagnoses and after revascularisation procedures. Previous surveys have suggested that uptake of outpatient cardiac rehabilitation services is low, with specific patient groups under-represented. To quantify the shortfall in cardiac rehabilitation service availability and uptake, estimates of current UK need and provision are required.

Barriers to participation in outpatient cardiac rehabilitation have been identified, but the effectiveness of interventions to improve uptake and adherence has not been assessed by systematic review. Such a review is needed to identify appropriate methods for increasing service use and to suggest areas meriting further research.

Previous economic evaluations of cardiac rehabilitation services have given a wide range of cost estimates and little information on costs other than those attributable to staffing. A thorough assessment of current UK costs of services is needed to include staff, overhead, equipment and capital costs. Furthermore, if greater numbers of patients are to receive outpatient cardiac rehabilitation an estimate of the cost implications of increasing provision by the establishment of new or expansion of existing services is required.

Chapter 2

Objectives

The questions posed in this project are as follows.

- What is the population need for cardiac rehabilitation?
- Who is not receiving cardiac rehabilitation?
- What is the effectiveness of different methods of improving uptake and of differential targeting of cardiac rehabilitation?
- What is the potential budget impact of increasing uptake of cardiac rehabilitation using different uptake interventions?

The questions will be tackled using the following sources of information:

- population need for cardiac rehabilitation in the UK from analyses of the English Hospital Episode Statistics (HES) and equivalent national databases
- provision and uptake of cardiac rehabilitation in the UK by means of a national survey of cardiac rehabilitation services, ad hoc surveys and audits
- uptake and adherence to cardiac rehabilitation from a recent multicentre RCT
- a systematic literature review of interventions to increase patient uptake, adherence and professional compliance with cardiac rehabilitation
- the costs associated with improving uptake and differential targeting of cardiac rehabilitation from the national survey, systematic review and costing data from sampled cardiac rehabilitation programmes.

Improving uptake of cardiac rehabilitation was conceived in a series of related stages: need for rehabilitation (in terms of ability to benefit from rehabilitation), coverage of existing services; pattern (i.e. by age, gender, ethnicity) of referral to services, and adherence in terms of both acceptance of invitation to attend services and completion of treatment. Interventions to improve uptake could be envisaged for each of these stages. This process is shown schematically in *Figure 2*.

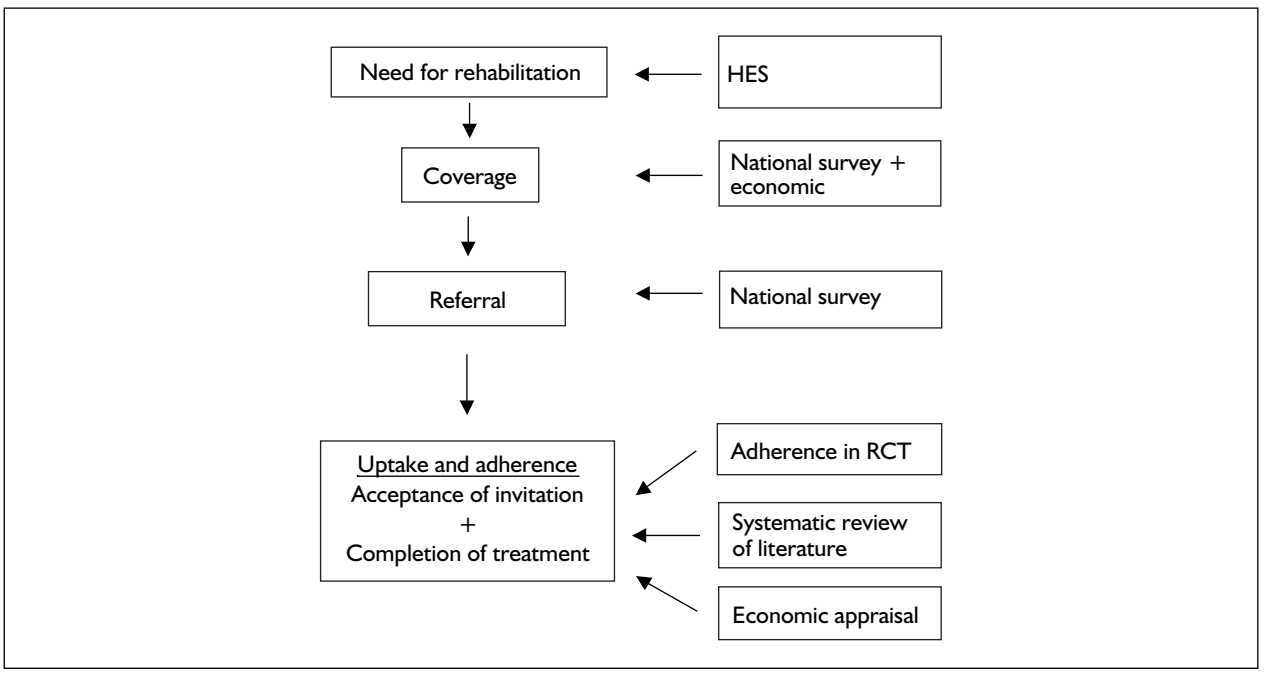

FIGURE 2 *Improving the uptake of cardiac rehabilitation*

Chapter 3

Population need for cardiac rehabilitation in the UK

Objectives

- Determination of the population need for cardiac rehabilitation in the UK by analysis of the English HES and similar national databases.
- Estimation of the level of uptake of cardiac rehabilitation by patients with a discharge diagnosis of coronary heart disease.

Background

The NSF-CHD states that every hospital should ensure that more than 85% of people discharged from hospital with a primary diagnosis of acute myocardial infarction or after coronary revascularisation are offered cardiac rehabilitation.[12] When cardiac rehabilitation is available to these patients, the NSF-CHD recommends that this service should be extended to patients with angina and heart failure. However, there is only limited information available on population need, that is, the total number of patients who may benefit from cardiac rehabilitation and the current nationwide level of service provision and patient uptake.

Methods

Data from the HES for England and similar sources for Wales [Patient Episode Database (PEDW)] and Northern Ireland [Hospital Inpatient Systems (HIS)] were used to estimate the need for cardiac rehabilitation, that is, the number of patients discharged from hospital who have the capacity to benefit from this therapy. Scottish data were not available. Data from England, Wales and Northern Ireland were collected from 1 April 1999 to 31 March 2000 and provide a comprehensive picture of the number of patients discharged from hospitals with particular conditions. Information was collected for all patients discharged alive from hospital with a primary diagnosis of ischaemic heart disease [International Classification of Diseases-10 (ICD-10) codes I20–I25]. Furthermore, data for subcategories of these patients were collected:

1. acute myocardial infarction (ICD-10 code I21)
2. heart failure (ICD-10 code I50)
3. unstable angina (ICD-10 code I20.0)
4. CABG (OPCS-4 codes K40–K46)
5. PTCA (OPCS-4 codes K49–K50)
6. CABG patients with one or more of the following discharge diagnoses or procedure codes: acute myocardial infarction, unstable angina, heart failure or PTCA
7. all other ischaemic heart disease cases.

Categories 1–7 are mutually exclusive, so that patients are only recorded once using either diagnosis or procedure codes. In case of multiple events with the same code each patient was only counted once. When a person was admitted more than once in a year, each extra admission was included.

The total number of patients eligible to receive cardiac rehabilitation was derived by adding the numbers in categories 1–7. These data were stratified by gender and age groups. Population statistics[84] were used to derive rates per 100,000 individuals.

The uptake of cardiac rehabilitation by eligible patients was estimated. Data from the 2000 BACR/BHF survey of cardiac rehabilitation services and an additional short postal questionnaire (as described in Chapter 4) were used to obtain the number of services and to estimate the total number of patients referred and joining outpatient cardiac rehabilitation in England, Wales, Scotland and Northern Ireland. In total, 284 centres were identified for the whole of the UK in 2000 (220 centres in England, 36 centres in Scotland, 18 centres in Wales and ten centres in Northern Ireland).

Of these, 191 (67%) responded to the additional questionnaire. Where a centre had not responded, a value relating to the upper interquartile range (IQR) derived from the responding centres was imputed and added to the aggregated figures of the responding centres to estimate the upper range of service provision for England. The lower range of service provision was similarly estimated by imputing, where data were missing for centres, the lower IQR derived from the responding

centres. Uptake was estimated from the number of eligible patients (using different need criteria given above) and the estimated number of patients referred, joining and completing cardiac rehabilitation. These estimates were then linked with the population need data.

Analyses were undertaken to estimate the level of uptake with different criteria of eligibility for cardiac rehabilitation:

- All patients with the above-mentioned discharge diagnoses and procedure codes were considered eligible.
- Only patients with acute myocardial infarction, unstable angina, CABG and PTCA were considered eligible.
- Only patients younger than 75 years were considered eligible.

The last two analyses were conducted by truncating the population data using these specified criteria.

Results

Based on hospital discharge statistics it was estimated that the total numbers of hospital discharged patients potentially eligible to receive cardiac rehabilitation in 2000 were as follows: England 266,833; Wales 17,560 and Northern Ireland 13,988. Total counts of discharged cases with acute myocardial infarction, heart failure, unstable angina, CABG and PTCA stratified by country, gender, age group and rates of discharge diagnoses and procedure code per 100,000 persons are presented in Appendix 1 (*Tables 35–37*).

Table 3 shows the estimated number of patients referred to and joining outpatient cardiac rehabilitation programmes by country. More detailed information is shown in Appendix 2 (*Tables 38–41*). Age, gender and diagnosis-specific estimates of need could not be provided as only a minority of cardiac rehabilitation centres were able to supply relevant information broken down by the variables required to link estimates of need to service supply.

Similar proportions of all eligible patients in England and Wales were referred to cardiac rehabilitation (between 22 and 36%). However, the proportion of referred patients in Northern Ireland was significantly less (12–17%). The proportions of all eligible patients joining cardiac rehabilitation programmes in England and Wales were also similar (13–21%), but joining was less common in Northern Ireland (9–12%).

Using more limited criteria of need for cardiac rehabilitation considering only patients discharged with a diagnosis of acute myocardial infarction, unstable angina or a procedure code of CABG or PTCA as eligible, under-provision was less marked, with about 45–67% referred to and 27–41% joining cardiac programmes in England (see *Table 3* for other countries).

TABLE 3 *Estimated uptake of cardiac rehabilitation by patients with different manifestations of coronary heart disease*

	England	Wales	Scotland	Northern Ireland
Estimated number of patients referred to CR[a]	59,400–87,200	4,600–6,400	5,800–9,100	1,700–2,400
Estimated number of patients joining CR[a]	35,700–53,100	3,000–3,600	3,500–6,000	1,200–1,700
Eligibility criteria				
All patients	266,800	17,700	NA	14,000
% referred to CR	22–33%	26–36%	NA	12–17%
% joining CR	13–20%	17–21%	NA	9–12%
Patients with AMI, unstable angina, CABG and PTCA	131,100	7,900	NA	6,800
% referred to CR	45–67%	59–81%	NA	25–36%
% joining CR	27–41%	38–46%	NA	18–25%
Patients <75 years	202,000	12,700	NA	11,200
% referred to CR	30–43%	36–50%	NA	15–22%
% joining CR	18–26%	24–29%	NA	11–15%

[a] Numbers estimated by imputing the IQR for non-responding centres.
AMI, acute myocardial infarction.

Provision was also estimated considering patients under age 75 years as eligible. This analysis suggests that 30–43% of patients were referred and 18–26% joined cardiac rehabilitation in England (see *Table 3* for other countries). A detailed summary of this analysis is displayed in Appendix 2 (*Tables 38–41*).

Discussion

The objective of this analysis was to estimate the population need for cardiac rehabilitation and to provide up-to-date information about the level of uptake of cardiac rehabilitation in the UK. This information should assist healthcare policy makers to improve the provision of cardiac rehabilitation services to all patients who have the capacity to benefit.

The analysis suggests that provision of cardiac rehabilitation at the inception of the NSF-CHD was low. This was still apparent when considering only patients with acute myocardial infarction, unstable angina, PTCA and CABG as eligible or, in a second analysis, only patients younger than 75 years.

There appears to be variation in service provision across the UK, with a higher proportion of eligible patients referred to and joining cardiac rehabilitation programmes in England and Wales than in Northern Ireland. Since the need for rehabilitation is substantially greater in Northern Ireland (and Scotland), this represents a considerable mismatch between uptake and need.

Although a different approach was used to estimate the level of service provision, the present findings are in concordance with previous research examining the relationship between need and supply. Bethell and colleagues estimated that between 14 and 23% of myocardial infarction patients, between 33 and 56% of CABG patients, and between 6 and 10% of PTCA patients attended cardiac rehabilitation in 1997.[26] The most recent update provided by the same group suggests that 17% of all myocardial infarction, 44% of all CAGB and 6% of all PTCA patients received cardiac rehabilitation in 2000.[25] It should be emphasised, however, that this estimate was based on only 69% of all UK centres. The true level of provision may be higher if non-participating centres were providing a service with better referral and joining rates, but this seems improbable.

The analysis presented here illustrates the lack of comprehensive and reliable data to estimate the level of service provision and should be interpreted with some caution. By using data from the HES a number of assumptions had to be made to estimate need. Although patients managed at home or in the private sector will be missed, it may be assumed that the HES are complete and a primary diagnosis of ischaemic heart disease indicates a need for cardiac rehabilitation. Furthermore, it is assumed that each finished consultant episode for these diagnoses equates to one person; the ratio of spells to finished consultant episodes is generally around one.[85]

However, the number of discharge diagnoses may be slightly higher than the number of patients because in some instances myocardial infarction patients receive revascularisation procedures such as CABG or PTCA within a few weeks. The time between these two distinctive admissions may not be sufficient for enrolment in a rehabilitation programme after the first event. The estimates assume that a patient suffering two or more events in a year represents a need for two (or more) courses of rehabilitation. This seems legitimate as such patients may be considered to be rehabilitation 'failures', and may have slipped through the net on earlier occasions.

Another potential limitation is the approach adopted to estimate the current level of service provision. These estimates are based on a postal survey with a response rate of 67% of the sampling frame of all cardiac rehabilitation centres existing in 2000 in the whole of the UK. Approximately 80% of these centres could provide data for the number of patients referred to and joining cardiac rehabilitation programmes and therefore the estimates are based on a sample of about 55% of all UK centres. However, by imputing the IQR to take account of missing data, the resulting estimates should provide a fair estimate of the current situation.

The apparent inability of centres to provide comprehensive activity data is possibly due to the lack of automated systems to extract these data, lack of audit facilities or centres being in the process of installing systems to collect audit data to satisfy the requirements of the NSF-CHD. Therefore, the current level of service provision could only be estimated indirectly by assuming that all patients with a primary diagnosis of ischaemic heart disease are eligible. Some limiting criteria of need were also used, namely restricting the eligibility for cardiac rehabilitation to certain

groups of patients (acute myocardial infarction, unstable angina, CABG and PTCA patients, and all ischaemic heart disease patients younger than 75 years). A more appropriate approach would be to obtain information on the number of patients referred to, joining and completing programmes stratified by gender, age and discharge diagnosis direct from cardiac rehabilitation centres and relate these to data that represent need, such as the HES, or to information obtained from hospitals in the catchment area of the rehabilitation service by means of comprehensive coronary heart disease registers.

It was not possible to assess the level of uptake of cardiac rehabilitation by patients of ethnic minority groups for two reasons. First, national hospital data stratified by ethnicity were only available for England. These were not completely coded for ethnicity, with about 30% missing data. Second, as reported in Chapter 4, the majority of centres in the BACR/BHF survey were not able to provide data on the referral and uptake of cardiac rehabilitation by ethnic minority groups.

Conclusions

The analysis suggests that the level of service provision of cardiac rehabilitation during 2000 was low. Therefore, the achievement of the NSF-CHD goal of 85% of acute myocardial infarction and revascularisation patients receiving cardiac rehabilitation is far from fulfilled. In addition, the shortcomings of this analysis clearly emphasise the need for a more comprehensive data collection to estimate reliably the provision of cardiac rehabilitation services and its relationship to need.

Chapter 4

Provision and uptake of cardiac rehabilitation in the UK: national survey of UK cardiac rehabilitation services

Objective

- Assessment of the provision and uptake of cardiac rehabilitation in the UK by means of a national survey of cardiac rehabilitation services.

Methods

BACR, with financial backing from the BHF, has conducted several surveys of cardiac rehabilitation services in the UK.[25,26,86] The authors of these reports have kindly provided this group with the data that they collected, and contact details of all services identified for the latest survey conducted in 2001, which included data from 1 January to 31 December 2000. This latest survey included questions concerning the total number of patients referred, joining and completing outpatient (phase 3) cardiac rehabilitation, the numbers broken down by diagnosis of myocardial infarction or cardiac surgery and by age groups and gender, time spent per week for each programme by various staff members, current funding and questions relating to outcome measures.

For the purposes of the current project there was also a need to know the numbers of patients from traditionally under-represented groups (women, the elderly, people from ethnic minority groups and people with heart failure or angina) referred, joining and completing cardiac rehabilitation programmes to be able to determine current service provision in these groups. There was also an interest in knowing how many services actively promoted adherence to programmes in these under-represented groups, and details of what interventions were used to achieve this. In terms of the extent of coverage and level of service provision, questions were asked for all patients and the study also sought to determine whether services had spare capacity for additional patients. A short postal questionnaire was devised specifically addressing these issues and sent to all those respondents of the 2000 BACR/BHF survey.

Results

By contacting the cardiac rehabilitation liaison person for each local health authority in the UK, 284 cardiac rehabilitation services were identified in 2000. Of these, 242 services responded to the BACR/BHF questionnaire, giving a response rate of 85%. The additional short postal questionnaire devised for the purposes of the current project (see letter of request and questionnaire in Appendix 3) was then sent to those respondents of the original survey, asking for information during the same period (1 January to 31 December 2000) so that data from the two sets of questionnaires could be linked. The response rate to this additional questionnaire following telephone prompting was 79% (191 questionnaires returned). Data returned were entered into a Microsoft Access database and transferred to STATA (Version 7) for data cleaning and analysis. Data are presented as proportions, medians, IQR and range, or means and standard deviations (SD).

Numbers of patients referred to, joining and completing cardiac rehabilitation programmes in 2000

Most services were able to provide this information, as shown by the relatively high number of responders in *Table 4* (maximum $n = 191$). Of the total number of patients referred, two-thirds of patients actually joined cardiac rehabilitation programmes and only half of those referred completed the programme. The number of patients attending individual programmes varied widely across the UK, as shown by the large ranges.

Capacity to increase provision

Thirty-one of 191 centres (16.2%) stated that they had spare capacity within their service, and could accommodate a median of four (two to 20) extra patients each week.

Level of service provision across the UK in 2000

The content of outpatient cardiac rehabilitation programmes was determined by the duration and

TABLE 4 *Overall referral, uptake and completion rates for UK cardiac rehabilitation programmes in 2000*

	Median	IQR	Range	No. of programmes	% of referrals
No. referred per centre	271	164–424	2–1564	156	
No. joined per centre	172	101–254	2–1066	153	63%
No. completed per centre	130	75–186	3–450	133	48%

TABLE 5 *Level of service provision for cardiac rehabilitation programmes in 2000*

	Weighted[a] mean (SD)	Range	No.[b] of programmes providing data
Exercise			
No. of weeks	7.4 (2.1)	1–12	144
No. of sessions per week	1.7 (1.5)	1–14	146
Average length of sessions (h)	1.2 (0.4)	0.5–3	145
Total time spent by patient (h)[c]	12.9 (1.7)	3–98	143
Average no. of patients per session	15.7 (6.2)	1–50	139
Health education			
No. of weeks	6.2 (2.1)	1–12	141
No. of sessions per week	1.3 (1.6)	0.25–14	141
Average length of sessions (h)	1.0 (0.4)	0.25–3	139
Total time spent by patient (h)[c]	7.0 (2.0)	0.75–98	139
Average no. of patients per session	16.1 (6.8)	1–40	132
Psychological intervention			
No. of weeks	5.0 (2.7)	1–12	126
No. of sessions per week	1.3 (1.5)	1–7	123
Average length of sessions (h)	0.8 (0.5)	0.17–2	122
Total time spent by patient (h)[c]	3.2 (2.0)	0.5–16	119
Average no. of patients per session	14.6 (6.1)	1–40	116

[a] Weighted by the size of the service (number of patients who joined). Data not normally distributed were transformed before weighting.
[b] Data were not provided for all questions by all services, so the numbers of respondents to each question are provided.
[c] Calculated as the number of weeks multiplied by the number of sessions per week multiplied by the duration of the session in hours.

the number and length of sessions for each of the component parts: exercise, health education and psychological interventions (stress management and relaxation).

The mean values across services have been weighted by the number of patients joining each programme. Again, there was a reasonable response rate to these questions, as shown by the relatively high numbers who provided data. *Table 5* highlights just how variable the programme content and intensity of each intervention is across the UK. Overall, exercise is the dominant component, with the total time spent by a patient almost twice that of health education and four times that of psychological interventions. This reflects the origins of cardiac rehabilitation, the weight of evidence for benefit from exercise-based programmes and the expertise of the principal members of most rehabilitation programmes.

Under-represented groups: number of referrals, joiners and completers broken down by age, gender, diagnosis and ethnicity

Response rates to questions on numbers of patients referred to, joining and completing programmes from under-represented groups were much poorer. Reported reasons included lack of automated systems and audit facilities, or that centres were in the process of installing systems to collect audit data to satisfy the requirements of the NSF-CHD.[12] The representativeness of *Table 6* should therefore be interpreted with some caution. The numbers of patients with heart failure or angina, or from ethnic minority groups, were so small that it was not possible to look at the proportions of those referred, joining and completing rehabilitation. Similar proportions of joiners and completers relative to those referred were seen for postmyocardial infarction patients

TABLE 6 *Under-represented groups: referral, uptake and completion rates for UK cardiac rehabilitation programmes in 2000*

		Median per centre per year	IQR	Range	*n*[a]	% of referrals
No. of male patients	referred	213	111–334	2–1066	83	
	joined	118	66–185	2–747	84	55%
	completed	84	43–154	2–329	65	39%
No. of female patients	referred	85	36–130	1–498	83	
	joined	36	17–60	1–319	84	42%
	completed	27	12–45	0–140	65	32%
No. of patients aged >65	referred	142	61–228	0–887	66	
	joined	72	37–152	0–596	71	51%
	completed	54	30–110	4–212	51	38%
No. of black/Asian patients	referred	5	1–19	0–196	59	
	joined	2	0–7	0–127	63	
	completed					
No. of post-MI patients	referred	160	78–286	0–881	97	
	joined	91	49–149	0–446	88	57%
	completed	66	31–103	0–425	69	41%
No. of CABG patients	referred	86	47–142	0–563	91	
	joined	50	22–99	0–407	83	58%
	completed	45	13–82	0–367	65	52%
No. of HF patients	referred	0	0–2	0–28	61	
	joined	0	0–1	0–12	59	
	completed	0	0–1	0–9	46	
No. of angina patients	referred	6	0–27	0–200	71	
	joined	1	0–8	0–134	70	
	completed	0	0–5	0–73		

[a] Data were not provided for all questions by all services, so the numbers of respondents to each question are provided.
HF, heart failure.

(not an under-represented group, here only for comparison), the over 65-year-olds and male patients, with slightly fewer women joining rehabilitation programmes relative to those referred. The number of patients post-CABG referred for cardiac rehabilitation shows relatively higher rates of completion than other groups.

Efforts to promote attendance in under-represented groups

Finally each service was asked whether they made any special efforts to promote adherence to cardiac rehabilitation programmes in each of the under-represented groups, and to detail any interventions that they used to achieve this. Of those services (126/191, 66%) that indicated that they promoted attendance in at least one of the under-represented groups, 46% stated that they promoted attendance in women, 48% in the elderly, 55% in revascularisation patients, 34% in ethnic minority groups, and 17% and 18% in patients with heart failure and angina, respectively.

Of the 126 services that stated that they promoted attendance in under-represented groups, 97 provided details of the interventions that they used to achieve this. A member of the report team with extensive clinical experience of cardiac rehabilitation delivery examined these free text responses. Among the under-represented groups there emerged themes of a variety of interventions that were being, or could be used generically, across the different patient groups, and some that were definitely more specific to each of the particular groups. These are presented in *Table* 7. The numbers in parentheses refer to the numbers of services which described each particular intervention. The majority of services that stated that they promoted adherence did so in a way that would benefit most patient groups; for example, follow-up phone calls, free transport, home visits and personalised invitations. Of those interventions that were specific to under-represented groups, individualised classes, appropriate 'buddy' systems, attendance of relative or spouse were among those most commonly stated. Direct referrals from surgery and specialist clinics were also used as methods to ensure uptake and adherence.

Conclusions

Although it is feasible to obtain useful information about means of improving uptake and adherence using ad hoc postal questionnaires, routine electronic audit data are likely to provide a more

TABLE 7 *Interventions used by cardiac rehabilitation programmes to improve uptake and adherence (number of programmes reporting indicated intervention)*

Any intervention (97)

Generic interventions
Follow-up telephone call post-discharge (69)
Preassessment clinic appointment and individualised coronary heart disease advice (58)
Free organised transport (51)
Home visit by specialist cardiac/BHF liaison nurse (43)
Personalised invitation by letter or telephone to attend (42)
Inpatient follow-up and verbal explanation (28)
Non-attenders followed up and offered further appointments (26)
Range and choice of menu options for classes (13)
Community GP and practice nurse encourage attendance (5)
Choice of sessions offered (venue/day/time) (5)
Anxious patients met at the entrance of the venue (1)
Travel grants and transport-sharing scheme (1)
Invitation letter marketed and evaluated to encourage uptake of classes (1)

Specific interventions for women
Women patients 'buddy' system (15)
Individualised exercise plans (14)
Separate classes for women (6)
Encouragement of husband or friend to attend (6)
Choice of community or hospital-site sessions (3)
Female volunteer befriending service and help-line (3)
Focus groups to assess women's needs (2)
Smaller exercise groups for women (1)
Health benefits for women explained (1)
Women's changing facilities (1)
Female-only staff to facilitate rehabilitation sessions (1)

Specific interventions for age > 65 years
Separate and smaller classes for the elderly/frail (6)
Flexible start date if patient slow to recover (4)
Elderly patients' buddy system (3)
Relative /spouse encouraged to attend (3)
Lower impact exercise class (3)
Choice of sessions offered (day and times) (3)
Focus groups to assess elderly needs (2)
Elderly volunteer befriending service and help-line (2)
One-to-one exercise supervision (1)
Elderly education sessions (1)
Audiotapes of education sessions (1)

Specific interventions for ethnic minority groups
Asian relative/friend encouraged to attend (8)
Coronary heart disease leaflets in Asian languages (5)
Audiotapes of education sessions (3)
Asian-speaking nurses for home visits (5), education and exercise (3)
Involvement of Asian support groups (3)
Community elders from voluntary sector supporting rehabilitation (3)
Asian education programme (3)
Asian patient buddy system (2)
Provision of culturally sensitive classes (2)
Regular Asian focus groups to assess need (1)
Separate exercise class for Asian women (1)
Encouragement to wear traditional dress (1)

Specific interventions for CABG/PTCA
Surgical tertiary centre referral system (13)
Specific revascularisation programme led by a revascularisation rehabilitation nurse (12)
Strong recommendation by surgeon/consultant (2)
Theatre list referral system (1)
Buddy system (1)
Preangiogram talk about rehabilitation (1)
Video about cardiac rehabilitation (1)

Specific interventions for angina
Specific angina education sessions (5)
No exclusion to attend (5)
Direct referral from rapid-access chest pain clinic (2)
Referral while awaiting CABG (1)
Buddy system (2)
Referral followed up by specialist angina nurse (1)

Specific interventions for heart failure
Specific heart failure programme (9)
Community specialist heart failure nurse encourages attendance (5)
No exclusion to classes (4)
Low-impact exercise classes (2)
Buddy system (1)
Community-based programme (1)
Audiotapes of health education provided (1)
One-to-one exercise supervision (1)

comprehensive picture, and more accurate data on referral and uptake.

Relative to post-myocardial infarction patients, older people and women tended to be less often referred and were less likely to join a programme. Data on ethnic minorities and those with diagnoses of angina and heart failure were too sparse to evaluate formally. However, the low numbers reported indicate that these groups are very unlikely to be referred or to join programmes.

Many different interventions are reported by services, suggesting high levels of awareness of the general problem of uptake. These interventions vary in complexity and cost; for those that are either complex or costly, more formal evaluation of their effects on uptake and adherence would be valuable. Examples of low-cost, sensible good practice (e.g. telephone call follow-ups) should be widely disseminated and would not require formal evaluation.

Chapter 5

Audit of cardiac rehabilitation in England: National Service Framework for Coronary Heart Disease recommendations

Objective

- Assessment of cardiac rehabilitation audit activity by survey of rehabilitation centres.

Background

Patient uptake of outpatient cardiac rehabilitation services is poor, particularly by under-represented groups including women, the elderly and ethnic minorities.[25,33,36] Although guidelines on provision of services exist,[2,4,87] audit of cardiac rehabilitation services has previously been piecemeal and not routinely undertaken and, where data exist, adherence to guidelines is poor.[88] In England, the NSF-CHD has recognised the benefits of comprehensive cardiac rehabilitation and the need for services to be extended.[12] It states that every hospital should ensure that more than 85% of patients discharged with a primary diagnosis of acute myocardial infarction or after coronary revascularisation are offered access to cardiac rehabilitation. This has implications for clinical governance and the need to audit cardiac rehabilitation services.

In view of the NSF stated objectives, the aim was to ascertain the level of cardiac rehabilitation audit activity in the south-west of England and areas with high ethnic minority populations in London and the midlands.

Methods

Cardiac rehabilitation centres in the south-west of England, London and the Midlands were contacted by telephone and asked to supply a report on their most recent audit. Information on any special efforts to improve attendance by specific patient groups (e.g. women, the elderly and ethnic minorities) was also requested. Centres reporting no available data were asked to provide reasons for not undertaking audit. Centres with audit data or a report available but that did not submit a copy were contacted a second time by telephone and subsequently by letter. The medical director of the NHS trust was then contacted, asking the hospital trust to follow-up the request.

Results

Response rate

From January to July 2002, 51/57 (89%) of cardiac rehabilitation centres that were approached were successfully contacted. Twenty-six centres (46%) responded to the first telephone request. Further contact by telephone and letter led to replies from one (2%) and eight centres (14%), respectively. Finally, after written communication with medical directors, replies were received from a further 16 centres (28%). Audit data were received from 24 (42%) centres, nine (16%) reported that an audit had been undertaken but did not send it, and 18 (32%) stated that no audit had ever been undertaken. Two centres supplied their audit as anonymous individual patient data and one centre was only able to provide an audit report limited to a single ethnic group.

Audit methods

The means of data collection varied between centres. It was not possible to determine the method of data collection by 12 centres (50%). Of those where this was clear, six (50%) relied on a 'paper system' with retrospective data extraction from patient notes and attendance registers, while six (50%) used regularly updated computerised databases. Commenting on the collection of data, respondents regarded paper systems as time-consuming, tedious and unreliable, while centres using computerised methods reported that frequently there was a lack of trained staff for data management.

The mean length of audit was 10.4 months (SD 2.8, range 4–12 months). Times for data collection also varied between centres. Mid-point dates were in 2002 (two hospitals), 2001 (ten

TABLE 8 *Audit activity specified in NSF-CHD*

Stated NSF-CHD recommendation	No. of centres collecting information (%) (*n* = 23)
No. (%) of patients discharged from hospital after coronary revascularisation or with a primary diagnosis of AMI	10 (43%)
Documentation of arrangements for cardiac rehabilitation in discharge communication to GP	0 (0%)
Information on gender of patients	20 (87%)
Information on age of patients	18 (78%)
Information on ethnic group of patients	16 (70%)
No. recruited to cardiac rehabilitation	21 (91%)
Outcome information: 1 year after discharge, regular physical activity of at least 30 min duration on average five times a week, not smoking, body mass index < 30 kg/m^2	2 (9%)

hospitals), 2000 (eight hospitals), 1999 (two hospitals) and 1998 (one hospital). One audit did not provide dates. The main reasons cited for not collecting audit data were: time constraints, lack of adequate resources and computing facilities, lack of appropriate personnel to input data, limited or no audit training, or lack of information technology support for the audit process.

National Service Framework

The number of centres collecting information as stated in the NSF-CHD for annual collection is presented in *Table 8*. The audit with data on a single ethnic group is not included.

Of importance is that data received were often not comparable. Regarding age, only six (26%) centres provided age information adequate for the assessment of attendance by age group. This was similarly the case with ethnicity, where only five (22%) provided information that permitted comparisons of cardiac rehabilitation uptake by ethnic groups. This information was more likely to be collected by centres in areas with high numbers of patients from ethnic minorities. Eleven out of 13 centres (85%) from areas with high ethnic minorities collected information on provision for specific ethnic minority groups, but in only four (31%) could this be used to assess some feature of uptake. In areas with relatively low numbers of patients from ethnic minorities limited information was reported by five out of 10 centres (50%), with only one centre collecting adequate information to assess differences in attendance rates (10%).

Of the 19 centres supplying relevant information, 12 (63%) provided rehabilitation for patients with myocardial infarction, coronary bypass surgery, angioplasty and heart failure. Six (32%) were exclusively for myocardial infarction patients and one (5%) for surgical patients.

TABLE 9 *Additional information included in audits*

Additional information collected	No. of centres collecting information (%) (*n* = 23)
Patient reasons for non-attendance	12 (52%)
Patient clinical history and risk factors	6 (26%)
Secondary prevention outcomes	4 (17%)
Patient opinions and satisfaction	2 (9%)
Patient's home postcode	2 (9%)
Psychological morbidity	1 (4%)
Exercise outcomes	1 (4%)
Reasons for non-referral	1 (4%)
Referrals by consultant	1 (4%)

Audits also contained information not directly relevant to the objectives of the NSF. This is summarised in *Table 9*.

Numbers of patients per year

The annual baseline mean number of patients discharged alive from hospital and eligible for cardiac rehabilitation and the numbers of patients referred to, attending and completing cardiac rehabilitation are presented in *Table 10* for all centres and for those providing services to a high proportion of ethnic minorities.

The proportion of discharged patients attending rehabilitation was 35% (weighted by number of patients discharged, SD 12, range 14–54%) and of those referred or invited to cardiac rehabilitation attendance was 55% (weighted by number of patients invited, SD 12, range 35–80%). Seventy-

TABLE 10 *Numbers and proportions of patients discharged alive, referred/invited, attending and completing cardiac rehabilitation per year*

	Mean no. (SD) of patients (range) (no. of centres)	Proportion of discharged[a] (no. of centres)	Proportion of referred/invited[a] (no. of centres)	Proportion of attended[a] (no. of centres)
All centres				
Discharged patients	390 (182) (167–684) (*n* = 10)			
Referred/invited for cardiac rehabilitation	308 (223) (62–1066) (*n* = 18)	59% (*n* = 7)		
Attending cardiac rehabilitation	176 (110) (23–533) (*n* = 19)	35% (*n* = 8)	55% (*n* = 16)	
Completing cardiac rehabilitation	148 (53) (66–233) (*n* = 8)	32% (*n* = 3)	48% (*n* = 8)	77% (*n* = 7)
Centres providing service to a high proportion of ethnic minorities				
Discharged patients	398 (184) (167–620) (*n* = 6)			
Referred/invited for cardiac rehabilitation	334 (262) (62–1066) (*n* = 11)	60% (*n* = 5)		
Attending cardiac rehabilitation	189 (135) (23–533) (*n* = 11)	29% (*n* = 5)	57% (*n* = 10)	
Completing cardiac rehabilitation	137 (58) (66–233) (*n* = 6)	37% (*n* = 2)	48% (*n* = 6)	79% (*n* = 5)

[a] For centres providing complete information.

seven per cent of patients (weighted by number of patients attending, SD 13, range 57–91%) attending a programme subsequently completed it.

The proportion of patients discharged who completed a programme was 32% (weighted by number of patients discharged, SD 6, range 28–42%). However, this was based on information from only three centres.

In five centres providing a service to a high proportion of ethnic minorities the percentage of discharged patients referred was significantly lower than in three centres from other areas surveyed and which provided appropriate data (29% compared with 45%). Otherwise, the proportions of patients referred, attending and completing programmes were similar.

Measures reported to improve patient attendance at outpatient cardiac rehabilitation

Eight centres (35%) reported a variety of measures to improve attendance and these are summarised in *Table 11*. Three of these measures concentrated on the uptake of ethnic minorities, one on women patients, but none on the elderly. Regrettably, information evaluating the success of these measures was not available.

TABLE 11 *Measures taken to improve attendance at cardiac rehabilitation*

	No. of centres reporting measures to improve attendance (%)
Community, non-hospital-based programme	5 (22%)
Translator or interpreter	3 (13%)
Evening programme	2 (9%)
Community liaison or link worker	2 (9%)
Women-only programme	1 (4%)
Programme for specific ethnic group	1 (4%)
Programme on days appropriate to religious beliefs	1 (4%)
Satellite services in local hospitals	1 (4%)
Audio information for visually impaired	1 (4%)

Discussion

Clinical governance incorporates audit to ensure that clinical care is up to date and effective.[89] However, a commitment to the accuracy, appropriateness, completeness and analysis of

healthcare information is required if judgements about clinical quality are to be made and the impact of clinical governance is to be assessed.[90]

Major barriers to clinical audit are lack of resources, lack of expertise or support, and organisational difficulties.[91] This survey highlighted that a minority of centres was able to provide information on outpatient cardiac rehabilitation audit, with one-third of centres reporting that no audit was available. Some centres reported that audit had been conducted, but were not eager to disseminate the information outside the hospital. This may reflect the perceived disadvantages associated with clinical audit of diminished clinical ownership and hierarchical and territorial suspicions.[91] Although the medical directors of NHS trusts were contacted future studies should consider methods to improve sharing of audit information.

Nearly half of the audits provided some relevant information on clinical audit as specified in the NSF-CHD. However, information on potentially under-represented groups was limited. To some extent the style and content of audit reports probably reflect local interests and concerns relating to cardiac rehabilitation provision. Basic information on the initiating event in particular, and on referral, invitation, attendance and completion was collected in sporadic and non-standard ways. A few audit reports were comprehensive, with comparison of total numbers of discharged patients and patient attendance and completion of outpatient cardiac rehabilitation. To allow comparison of provision between centres and over time, a baseline figure of total initiating events is required, as well as information on invitation to, and completion of, the programme. Examples of clinical audit tools have been included in cardiac rehabilitation guidelines.[2,4] However, with the exception of initiating event, these have been limited in their inclusion of information on potential sources of under-representation. A more recent resource considers age, gender and ethnicity,[92] and is currently under evaluation.[93] Development and acceptance of a comprehensive, standard audit tool with flexibility regarding local issues would be helpful for use in future audits. It may be possible to merge this into a hospital critical care pathway and routinely collected Myocardial Infarction National Audit Project (MINAP)[94] data. If the targets laid down in the NSF-CHD are to be met and the health outcomes are to be successful then the challenge lies in the development of an effective and uncomplicated audit tool that can be applied nationally to serve all cardiac populations.

A difficulty identified in several audits and from centres unable to provide information was that patients may be referred to a programme from one or more hospitals or from one hospital to several different programmes. This complicates the audit of programmes in both urban and rural settings. In one city unable to provide audit information a group of hospitals reported the imminent introduction of a joint database.

Where available, audits of outpatient cardiac rehabilitation varied considerably in style and content. Some were thorough documents covering many aspects of audit, whereas other centres had been unable to prepare a formal document but were able to provide raw data. Some audits were prepared by staff trained in clinical audit, whereas others were by less experienced staff or were student projects. Other facilitating factors for audit include modern medical records systems, effective training, dedicated staff, protected time, structured programmes, and a shared dialogue between purchasers and providers.[91]

Only a minority of centres was able to provide complete information on numbers of patients referred (seven centres) and who attended cardiac rehabilitation (eight centres) in relation to numbers discharged. There was a suggestion that referral and invitation of patients were similar in centres providing services in areas with high proportions of ethnic minorities compared with centres in other areas. However, the proportion of patients attending a programme was lower in areas with high ethnic minority populations. Changes to services and interventions to improve uptake of cardiac rehabilitation by ethnic minority groups may be indicated.

A series of measures had been undertaken by centres to help patients to participate in outpatient cardiac rehabilitation. These ranged from holding classes in community settings and at times to suit patients, to the establishment of classes dedicated to women or ethnic groups. As interventions may be of interest to other centres, evaluation by controlled trials or within a reproducible audit framework would be valuable in determining their overall effectiveness in improving attendance at outpatient cardiac rehabilitation.

Conclusions

The findings from this more detailed survey of audit activity complement those obtained from the

national survey of cardiac rehabilitation services presented in Chapter 4. The authors had hoped to be able to find interventions specific to under-represented groups by focusing on services located in areas with relatively high proportions of black and ethnic minorities and with rather more aged populations (the south-west of England). However, the quality of audit, the reports and the data collected were insufficient to support robust interpretation of the performance of these services.

The findings highlight a national uncoordinated approach to audit data collection in England with large variations in methods and content despite the standards set out in the NSF and cardiac rehabilitation guidelines. The use of modern medical records systems, appropriate training for dedicated staff and dialogue between all contributors to services is suggested. Development of a national and policy-driven standardised audit tool would facilitate the identification of patients by cardiac event and the following of all patients through the cardiac rehabilitation process.

Limited analysis of audit data suggests that uptake of cardiac rehabilitation is particularly low in areas with high proportions of ethnic minorities. Information on under-represented groups and local interests should be incorporated into audit data collection in a standardised way so that future care can be targeted to the needs of the local cardiac population.

Some cardiac rehabilitation programmes have attempted to improve attendance with measures appropriate for all patients or for specific groups. Evaluation and dissemination of information on effective and ineffective interventions may help other programmes to improve services and use resources appropriately.

Chapter 6

Uptake and adherence in a randomised controlled trial of cardiac rehabilitation after myocardial infarction

Objective

- To evaluate uptake and adherence using data from a recent multicentre RCT.[95]

Introduction

In the UK provision of rehabilitation for patients following acute myocardial infarction is a requirement of the NHS-CHD[12] and comparable guidelines in Scotland and Wales.[2,18] Before discharge all patients should be invited to participate in a multidisciplinary cardiac rehabilitation and secondary prevention programme. Some patient groups are not thought to benefit from the exercise component of cardiac rehabilitation after acute myocardial infarction. Patients with more severe cardiac illness and those with psychiatric conditions that may compromise safety are considered ineligible.[96] Pragmatically, patients with poor functional capacity, significant co-morbidity, frailty or confusion are not suitable for outpatient-delivered rehabilitation. Consequently, these factors may influence referral and uptake in clinical practice.

The uptake and adherence achieved in a clinical trial setting was examined because this should reflect the best that can be achieved in optimal routine clinical practice.[95] It would certainly be unlikely that NSF targets representing a higher level of uptake and adherence than that seen in a contemporary trial would be feasible. Where appropriate, data for all patients discharged after myocardial infarction were analysed. For issues relating to attendance only those patients allocated to cardiac rehabilitation were considered.

Methods

Patients were recruited in 18 typical acute general hospitals in England and Wales. The trial protocol planned for all potentially eligible myocardial infarction patients to be identified on confirmation of diagnosis. At discharge ineligible patients (significant co-morbidity, etc.) were excluded under protocol guidelines of minimal exclusions and reasons were recorded, usually by a nominated coronary care unit nurse. Patients eligible for rehabilitation were advised of the trial in an introductory letter.

Each patient was visited by a research interviewer approximately 1 week after discharge. Patients were given full details of the trial and, after being asked for informed consent, answered the baseline structured interview. Following entry into the trial and central blind randomisation, the names of patients allocated to cardiac rehabilitation were given to rehabilitation teams for invitation, treatment and follow-up as normal practice for the programme.

There were two opportunities for patient selection: by hospital medical or nursing staff (before trial entry) according to criteria in protocol; or by cardiac rehabilitation staff (after randomisation). There were also three opportunities for refusal of the trial or rehabilitation by patients: when advised of the trial by hospital staff; after a full description of the trial and informed consent by the research interviewer; or when given the date, time and venue of their first rehabilitation appointment. Patients were interviewed after 1 year and asked about their experiences of cardiac rehabilitation.

Results

The collection of names of potentially eligible patients and recording of clinical summaries were not complete in all hospitals. Some progressively reduced the flow of forms of excluded patients. Consequently, analyses were undertaken both for all hospitals and for those hospitals in which record-keeping was thought to be nearly complete.

In total, 3264 potentially eligible patients were identified in the 18 hospitals. Of these, 1400 were in five hospitals with complete registration.

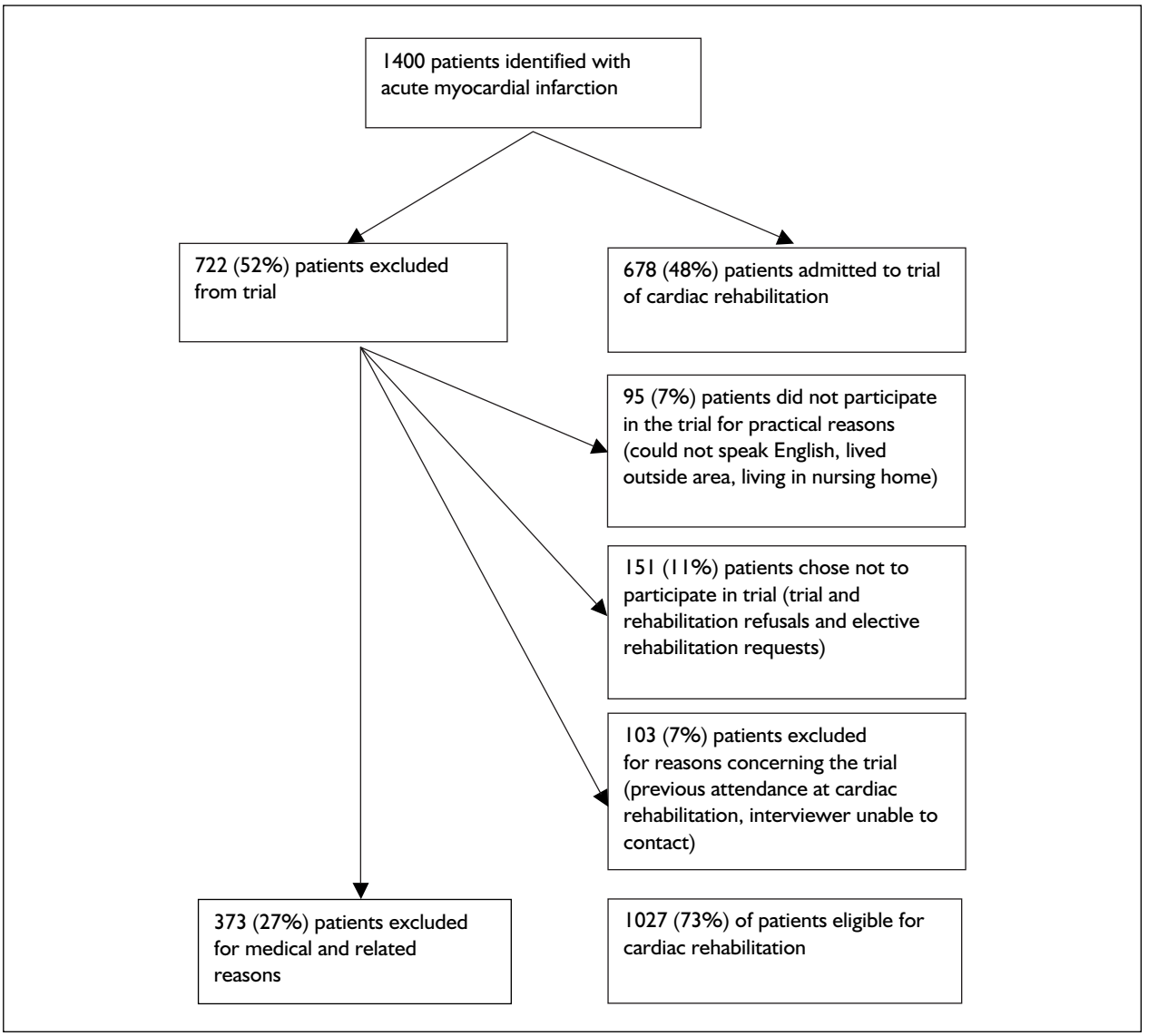

FIGURE 3 *Exclusions from trial hospitals reporting complete myocardial infarction registration*

Figure 3 shows reasons for exclusion from the trial and overall eligibility for cardiac rehabilitation in the hospitals with complete registration. Seventy-three per cent of patients had no medical reason (identified during hospital stay by medical or nursing staff) for not attending a programme of cardiac rehabilitation. Thus, nearly three-quarters of patients discharged within 28 days following myocardial infarction were deemed eligible for cardiac rehabilitation.

Follow-up interviews were completed for 959 patients randomised to rehabilitation at approximately 1 year, by when 75 patients had died. Attendance information for a further 91 patients was provided by rehabilitation coordinators.

Medical reasons for exclusion, identified during the hospital stay, are shown in *Table 12*. Some of these patients may have been eligible for rehabilitation at a later date or in a different hospital (patients awaiting surgery, transferred to another hospital, having extended hospital stay or being readmitted). Including these patients raises eligibility from 73 to 81%.

Patients excluded from rehabilitation for medical reasons tended to be older (mean age 71.9 years compared with 64.6 years for eligible patients, $p < 0.0001$) and were more likely to be female (36.5% versus 21.9% males excluded, $p < 0.0001$). *Table 13* shows patient exclusion in males and females in different age groups. There was a trend for increasing exclusion in both men and women

TABLE 12 *Reasons for exclusion in hospitals with complete patient registration*

	No. of patients (%)
Admitted to trial	678 (48.4%)
Practical, personal and trial exclusion	349 (24.9%)
Medical exclusion:	
Significant co-morbidity	75 (5.4%)
Frail or confused	154 (11.0%)
Transferred to other hospital	75 (5.4%)
>28 days in hospital	13 (0.9%)
Readmitted within 28 days	16 (1.1%)
Awaiting surgery	5 (0.4%)
Uncooperative	7 (0.5%)
Other	28 (2.0%)
Total	1400

with age. In multivariate analysis the association between gender and exclusion was not significant after adjustment for age.

Excluded patients tended to have pre-existing cardiovascular disease (previous myocardial infarction or angina) or more severe presentation of the index myocardial infarction (*Table 14*). However, previous hypertension was not associated with eligibility.

In total, 2144 patients were entered into the trial. Of these, 1100 were allocated to cardiac rehabilitation. Attendance figures are shown in *Table 15*.

Not all patients allocated by the trial to rehabilitation were offered cardiac rehabilitation. At least 22% and possibly as many as 33% of patients considered eligible by medical or nursing staff at time of discharge were not offered rehabilitation by cardiac rehabilitation staff. Patients invited tended to be younger than those not invited (mean age 62.8 years compared with 68.1 years) with a clear trend for non-invitation in older age groups (*Table 16*).

There was a tendency for women to be overlooked more often than men (31% compared with 22%). In less elderly patients (under 70 years), 18% of women were overlooked compared with 13% of men. However, the trend was not significant in multivariate analysis.

At interview, patients who had been invited to cardiac rehabilitation (n = 721) estimated the number of classes that they had attended and, if appropriate, gave reasons for non-attendance or dropout. Overall, 78% of patients invited to rehabilitation attended at least one session. Of patients aged 65 years or more 72% attended at least one session compared with 82% of those younger than 65 (p = 0.001). These data provide support for the observation that older patients are less likely to attend cardiac rehabilitation than younger patients. There were no statistically significant differences in initial uptake between men and women (79% versus 74%).

TABLE 13 *Medical exclusions by age and gender (1349 patients with age and gender known)*

Age at MI (years)	Male exclusions (% potentially eligible)	Female exclusions (% potentially eligible)	All exclusions (% potentially eligible)
<45	14 (25%)	4 (44%)	18 (28%)
45–54	21 (13%)	2 (5%)	23 (12%)
55–64	38 (16%)	13 (19%)	51 (16%)
65–74	50 (19%)	34 (27%)	84 (21%)
75–84	53 (34%)	69 (47%)	122 (40%)
85+	18 (56%)	31 (67%)	49 (63%)
All ages	194 (21%)	153 (35%)	347 (26%)

TABLE 14 *Medical exclusions by previous cardiovascular disease and more severe sequelae of myocardial infarction*

	Eligible	Medical exclusion	*p*
MI previous to index event	16.50%	26.70%	$p < 0.0001$
Previous angina	30.50%	44.10%	$p < 0.0001$
Previous hypertension	31.70%	31.00%	$p = 0.441$
MI with left ventricular failure	29.10%	49.60%	$p < 0.0001$
MI with cardiogenic shock	1.60%	7.30%	$p < 0.0001$

TABLE 15 *Patient attendance in trial rehabilitation groups*

	No. of patients (%)
Not offered/did not attend	238 (21.6%)
Not known whether offered/did not attend	66 (6.0%)
Offered/did not attend	162 (14.7%)
Attended one class	45 (4.1%)
Attended two to four classes	57 (5.2%)
Attended five or more classes	454 (41.3%)
Attended but number not known	18 (1.6%)
Not known whether offered or attended	60 (5.5%)
Total	1100

TABLE 16 *Non-invitation by age group*

Age group (years)	Not invited
<45	7 (11.3%)
45–54	21 (12.2%)
55–64	50 (17.2%)
65–74	87 (22.9%)
75+	73 (37.2%)
Total	238

Patients with a history of cardiovascular disease before the index myocardial infarction were slightly less likely to attend rehabilitation: previous hypertension (27% versus 21%) and previous myocardial infarction (30% versus 22%), but these differences were not statistically significant.

If invited, patients who had suffered a more severe myocardial infarction (complicated with left ventricular failure or cardiogenic shock) were as likely to attend as those without complications. Seventy-seven per cent of patients with left ventricular failure attended compared with 78% of those without. For cardiogenic shock the numbers are small, but of 12 affected patients, 11 attended rehabilitation (92%) compared with 78% of those without.

Having attended one class, 79% of patients attended five or more sessions. Women were slightly less likely than men to attend five or more sessions (75% versus 80%), although this was not statistically significant.

Reasons reported for not attending or attending fewer than five sessions are shown in *Table 17*.

The main reasons given by patients at the 1-year follow up interview for non-attendance were lack of interest and perceived illness. However, 34% reported reasons for non-attendance or dropping out that might have been avoided with appropriate management. These included transport difficulties, returned to work, holidays, other appointments, administrative failure, dissatisfaction with course, dependent relative, considered unnecessary by department, attended other course and taking part in another trial.

Discussion

This analysis showed that some cardiac rehabilitation programmes used selection. This may reflect local provision issues or the lesser importance assigned to rehabilitation of patients following acute myocardial infarction compared with cardiac surgery. Although the analysis of reasons for exclusion is based on 1400 patients from five hospitals, a less representative

TABLE 17 *Reasons for non-attendance or attendance at fewer than five sessions in patients offered cardiac rehabilitation*

Reason for non-attendance	No. of patients (%)
Not interested or lost interest	71 (23.6%)
Too ill	62 (20.6%)
Transport difficulties	43 (14.3%)
Returned to work	18 (6.0%)
Holiday or other appointments	15 (5.0%)
Recommended not to by doctor or rehabilitation staff	13 (4.3%)
Rehabilitation department administrative failure	9 (3.0%)
Dissatisfaction with course (age group, male/female, content)	6 (2.0%)
Taken ill at rehabilitation class	6 (2.0%)
Looking after dependent relative	6 (2.0%)
Rehabilitation staff thought unnecessary (fit enough)	3 (1.0%)
Attending another rehabilitation course	2 (0.7%)
On another trial	1 (0.3%)
Not known	46 (15.3%)
Total	301

sample of hospitals than the 18 trial hospitals, a similar pattern is observed in the whole sample.

It is not possible to differentiate trial refusals from cardiac rehabilitation refusals. By refusing to participate in the trial, patients may be seeking cardiac rehabilitation or may be turning it down. However, in an audit of rehabilitation services both these patient groups must be considered as eligible. Patients who were excluded from the trial for methodological (trial) reasons may have been eligible and contactable if given a definite invitation while in hospital. Patients excluded for the practical reason of living outside the area may have been eligible for a cardiac rehabilitation programme local to their home. Indeed, it is possible that these patients received rehabilitation elsewhere. At the time there were no specific interventions to facilitate uptake by patients who spoke no English, in the study hospitals (specific programmes for non-English-speaking patients may have been introduced more recently). It is unlikely that they would have received rehabilitation elsewhere.

The reasons reported by patients for non-attendance at and for early dropout from a cardiac rehabilitation programme suggest that uptake may be improved by addressing issues of motivation and the perceived relevance of rehabilitation to future well-being, minor co-morbidities or perceived illness, site and timing of sessions, transport and arrangement of care for dependants.

Conclusions

Medical and nursing staff identified 73–81% of patients discharged from hospital after acute myocardial infarction as being eligible for cardiac rehabilitation. Excluded patients tended to be older, were more likely to have suffered from angina or had a previous myocardial infarction and showed more severe presentation of cardiovascular disease. Reduced invitation and attendance of women was largely explained by their greater age at myocardial infarction. The experiences of patients invited to cardiac rehabilitation suggest that uptake may be improved by addressing issues of motivation and the perceived relevance of rehabilitation to future well-being, co-morbidities, site and time of sessions, transport and arrangement of care for dependants.

Chapter 7

Systematic review of interventions to improve uptake, adherence and professional compliance with cardiac rehabilitation

Chapters 7–10 present the methods and findings for a series of related systematic reviews. The issue of improving uptake was split into three major questions: how can recruitment to cardiac rehabilitation be improved; how can patients' adherence to cardiac rehabilitation and maintenance of lifestyle changes be improved; and, how can professionals be encouraged to comply with guidelines and good practice? The sources of data to answer these questions may overlap, as researchers will not necessarily have conceived their questions in the same form as the present group has. With awareness of this, it was ensured that each pair of reviewers dealing with a specific question read source material with a view to identifying potential relevance to other questions.

Definitions

- **Uptake**: patients attending any outpatient cardiac rehabilitation (i.e. successful recruitment).
- **Adherence**: patients attending all or majority of outpatient programme, or maintaining lifestyle changes associated with cardiac rehabilitation.
- **Professional compliance**: healthcare professionals complying with guidelines or good practice regarding invitation and support of patients' cardiac rehabilitation.

Objective

- How effective are different methods for improving uptake, adherence or professional compliance with cardiac rehabilitation?

Methods

A systematic review of interventions to increase uptake, patient adherence and professional compliance with cardiac rehabilitation is described. This was supported by members of the Cochrane Heart Group (KR, MB) who assisted with designing search strategies and identifying reports.

Data sources

A general search strategy was designed to identify all studies relating to the uptake, adherence or compliance with cardiac rehabilitation services. The choice of sources was intended to find both published and unpublished studies (grey literature). Details of terms used in the search are given in Appendix 4. The terms used were those for 'heart disease' together with terms for 'cardiac rehabilitation'. A broad approach to rehabilitation terms was chosen to identify not only formal cardiac rehabilitation programmes but also non-traditional programmes that could contribute to cardiac rehabilitation. Studies identified were further searched for terms relating to uptake, adherence, compliance and costs. Study methodology terms were not included, as the intention was to find all studies irrespective of methodology used. No language restrictions were applied.

The following databases were searched from inception (as appropriate) to June 2001:

- MEDLINE on Ovid
- EMBASE on Ovid
- the Cochrane Library (2001 Issue 2). This includes the Cochrane Controlled Trials Register, Cochrane Database of Systematic Reviews, Database of Reviews of Effectiveness (DARE), HTA Database and NHS Economic Evaluation Database
- CINAHL on Ovid
- PsycINFO on BIDS Silverplatter WebSPIRS
- ISI Web of Science and ISI Proceedings
- ECONLIT on Silverplatter WebSPIRS
- British Library Inside
- SIGLE (System for Information on Grey Literature in Europe)
- HMIC (Health Management Information Consortium database)

- COPAC (joint catalogue of CURL – the Consortium of University Research Libraries)
- National Research Register.

Additional searching of literature:

- The *Journal of Cardiopulmonary Rehabilitation*, 1990–2001, was handsearched.
- *Coronary Health Care*, 1997–2001, was handsearched.
- Abstracts from conference proceedings were handsearched:
  - American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR)
  - American College of Cardiology (ACC)
  - British Cardiac Society (BCS)
  - British Association for Cardiac Rehabilitation (BACR)
  - European Society of Cardiology (ESC)
  - International Network of Agencies for Health Technology Assessment (INAHTA)
  - Society for Social Medicine (SSM)
  - World Congress of Cardiology (WCC).
- The reference lists of relevant studies and reviews were scanned.
- Expert opinion was sought.

Study selection

Preliminary literature searches suggested that only a small number of RCTs would be found and that non-randomised studies would form an important part of the review. Consequently, all studies reporting evaluations of interventions were considered. A total of 3261 references was identified in the searches, and the title and abstract of each article were examined by at least one reviewer. Articles were only rejected if the reviewer could determine from the title and abstract that the article was not a report of an intervention. When a paper could not be rejected with certainty, the full text of the article was obtained for further evaluation. A total of 957 references was identified as potentially relevant and acquired for more detailed consideration.

There was concern about publication bias and therefore special efforts were made to identify studies that might report negative findings by searching the grey literature, and handsearching abstracts of scientific meetings. Many of the identified interventions were found in the grey literature, which tends to include studies reporting lower effectiveness than those published in journals.[97] No attempt was made to contact authors of studies as a lower response rate was anticipated for supplementary information from authors of conference abstracts and theses compared with authors of published papers, which would tend to bias the information towards studies with more favourable outcomes.

After the discarding of purely descriptive reports two reviewers (from AB, KR, SE, MB, IG, FT and RW) assessed articles using a three-question inclusion/exclusion form (Appendix 5). A third reviewer (SE or KR) resolved disagreements over inclusion/exclusion.

Reports were included for data extraction if the following criteria were met:

- evaluation of intervention to increase uptake, patient adherence or professional compliance to cardiac rehabilitation
- patients with myocardial infarction, CABG or PTCA, with heart failure or angina, or coronary heart disease
- outcomes relevant to the reviews, specifically numbers attending and patient adherence to cardiac rehabilitation and its exercise, education and lifestyle components.

Data extraction

Once the decision had been made to include studies in the review two reviewers independently abstracted the relevant data (data extraction form in Appendix 6). Data extracted included details of patients, intervention, study type, quality and results. No attempt was made to contact authors for additional information.

The quality of non-randomised studies was recorded in accordance with recent reviews, specifically information relating to selection bias, power and analysis.[98] No formal scale was used to categorise quality, but features of individual studies are presented in the results sections. The method of group allocation, sample size, comparison of group characteristics at baseline and concomitant service changes independent of the intervention are used as the basis for quality assessment.

Analysis

The systematic review takes the form of three qualitative overviews. No attempt was made to pool study results as the number of trials was small and the study designs and interventions varied. Studies are grouped by quality of evidence. The best evidence comes from RCTs while non-randomised and before-and-after study designs provide less reliable evidence.[99,100] Studies were characterised by type and size, participants, intervention, comparison group, principal and other outcomes, and authors' conclusions.

Chapter 8

Systematic review of interventions to improve uptake of cardiac rehabilitation

Background

Barriers to attendance at outpatient cardiac rehabilitation have been identified, but the effectiveness of interventions to improve uptake has not been assessed by systematic review. Such a review is needed to identify appropriate methods for increasing patient use of services and to suggest areas meriting further research. For the review uptake was defined as any patient attendance at outpatient cardiac rehabilitation (i.e. successful recruitment).

Results

Studies included in review of interventions to improve uptake of cardiac rehabilitation

The flow of articles through the review process is shown in Appendix 7 in accordance with Quality of Reporting of Meta-analyses (QUOROM).[101] Twenty-seven articles reporting 22 studies were identified as relevant to the review of methods to improve uptake of cardiac rehabilitation and were formally included in the review. Reading by two reviewers (AB and RW) found eight studies reporting evaluation of an intervention relating to uptake by an appropriate patient group and with a relevant outcome.

A brief summary of each study is shown in *Table 18*, with detailed descriptions presented in Appendix 8. More than one report was identified from the trials of Jolly and colleagues[102–104] and Wyer and colleagues.[105,106] The reference providing the main source of information for the systematic review is cited in the tables and text.

Studies excluded from review of interventions to improve uptake of cardiac rehabilitation

Sixteen papers describing 14 studies selected for data extraction but not included in the review are summarised in Appendix 9. One paper reporting a before-and-after study of an intervention to improve uptake of cardiac rehabilitation by CABG patients was published after June 2001.[112] Eight studies had either no outcome data[113–119] or no comparison group,[120] or the study was retrospective in design.[121] In five studies the outcomes were referral[122,123] or commitment to participate,[124] or the study was related to secondary prevention.[125–127]

Methodological qualities of studies included in review of interventions to improve uptake of cardiac rehabilitation

Six studies reported interventions with a specific objective of increasing uptake of outpatient cardiac rehabilitation.[41,82,104,106,110,111] Two papers described interventions to improve uptake of community or voluntary services (cardiac or heart clubs) after discharge from inpatient cardiac rehabilitation.[108,109] All studies were of patients with myocardial infarction, and in two studies patients with angina[104] and following cardiac surgery[110] were included.

Three of the eight studies were RCTs, with randomisation on an individual basis in two[106,108] and by general practice in one.[104] Methods of randomisation and blind outcome assessment were clearly described for two of the three RCTs[104,106] and intervention groups were similar at baseline in all three trials.

Five articles reported non-randomised comparisons.[41,82,109,110,111] In one study a district providing an intervention was compared with a district with no intervention.[82] The districts had populations with similar demographics that were served by the same general hospital. The other four papers reported uptake of cardiac rehabilitation in periods before and after implementation of an intervention.[41,109,110,111] Baseline characteristics of groups were not reported in these studies. One before-and-after study reported percentage uptake but did not provide patient numbers or tests of statistical significance.[110]

TABLE 18 *Studies evaluating interventions to improve uptake of cardiac rehabilitation*

Authors, year and country	Study type and patients	Intervention	Findings relevant to uptake	Comments
RCTs				
Wyer *et al*., 2001[106] UK	RCT, 87 MI patients	Letters based on the theory of planned behaviour (Ajzen & Madden)[107] designed to increase attendance at CR	Uptake of outpatient CR was 86% in the intervention group and 57% in the control group ($p < 0.0025$)	Intervention open to alternative interpretation; letters conveying a 'fear' message
Hillebrand *et al*., 1995[108] Germany	RCT, 94 MI patients	Following inpatient CR patients had four telephone and at home conversations with social worker over a 6-month period	57% of patients who received the intervention attended a cardiac group compared with 27% of controls ($p < 0.005$)	Outcome is cardiac group attendance after inpatient CR
Jolly *et al*., 1999[104] UK	Cluster RCT, 67 general practices, 597 MI and angina patients	Liaison nurse encourages patients to see practice nurse after discharge and supports practice nurses. Patient-held record card to prompt and guide follow-up	42% of patients in the intervention group attended at least one outpatient CR session compared with 24% of controls ($p < 0.001$)	Multifaceted intervention. Management of patients in control practices not explicit
Non-randomised studies				
Osika, 2001[82] UK	Comparison of two districts with different provision, 175 MI patients	Weekly home visits by trained lay volunteers and accompaniment to first CR session	In the district with lay volunteer visiting 71% of patients attended a first appointment at outpatient CR compared with 47% in the control district ($p = 0.02$)	Intensity of lay volunteer visiting comparable with typical CR
Krasemann & Busch, 1988[109] Germany	200 MI patients attending in different periods	After completion of inpatient CR pamphlet given with information designed to motivate patients to join an outpatient heart group	66% of patients who received the intervention attended a heart group compared with 31% in the control group ($p < 0.001$)	No baseline group comparisons
Mosca *et al*., 1998[41] USA	Before-and-after study, 199 MI patients	Prompt for outpatient CR in discharge critical care pathway	Critical care pathway associated with a non-significant increase in outpatient CR participation (OR 1.9, 95% CI 0.6 to 5.5).[a]	No baseline group comparisons
Imich, 1997[110] UK	Before-and-after study, MI and cardiac surgery, patient number not reported	Nurse support, education and counselling in the postdischarge, preoutpatient CR period	Attendance at outpatient CR by invited patients increased from 55% before to 75% after instigation of the programme	Patient numbers not reported, so not possible to assess statistical significance
Scott *et al*., 2000[111] Australia	Before and after study, 649 MI patients	Dissemination of clinical guidelines to hospital staff and GPs. Feedback on clinical indicators	After intervention outpatient CR utilisation increased from 24% to 54% ($p = 0.003$)	Baseline period corresponds to CR programme start-up

[a] Lower 95% CI estimated.

Themes identified from the review of interventions to improve uptake of cardiac rehabilitation

The interventions identified in the systematic review can be grouped into four themes: healthcare professional-led interventions at the patient level, trained lay volunteers, coordination of postdischarge care at the service level, and written motivational communications.

Healthcare professional-led interventions at the patient level

Three studies were identified but none satisfactorily assessed the value of patient contact with healthcare professionals in improving cardiac rehabilitation uptake.[104,108,110] In the RCT of Hillebrand and colleagues[108] attendance at a cardiac group after inpatient rehabilitation was significantly increased in myocardial infarction patients who received regular contact with a social worker. The social worker–patient contacts at times relevant to improvements in uptake were a visit in hospital and a telephone call 4 weeks after discharge. The authors considered this to be a motivational intervention. In the before-and-after study of Imich[110] postdischarge at-home nursing support for myocardial infarction and cardiac surgery patients was associated with improvements in attendance at outpatient cardiac rehabilitation. However, little information relating to study quality and conduct was reported. In the nursing intervention reported by Jolly and colleagues,[104] although patients saw a liaison nurse in hospital before discharge the intervention was aimed mainly at professional organisation of care and is discussed in that section.

Trained lay volunteers

One study looked at an intervention with trained lay volunteers.[82] In the thesis, Osika[82] describes increased cardiac rehabilitation uptake associated with an intervention by trained lay volunteers. The study compared myocardial infarction patients in two districts with similar populations served by the same general hospital. In one district patients were offered the assistance of a patient who had previously attended cardiac rehabilitation. Patients in the district with the lay volunteer intervention were significantly more likely to attend the first session of the outpatient cardiac rehabilitation programme. In the absence of randomisation the author attempted to validate the method by reporting similarities in demographics and service access between groups.

Coordination of referral and postdischarge care at the service level

Interventions aimed at increasing uptake of outpatient cardiac rehabilitation by improving the coordination of postdischarge care were reported in three studies.[41,104,111] Jolly and colleagues[104] reported a cluster RCT of coordination of care between hospital and general practice by specialist cardiac liaison nurses for myocardial infarction and angina patients. Attendance at one or more cardiac rehabilitation sessions was significantly increased in the intervention group. The intervention consisted of three main elements: liaison nurse encouragement for patient to see practice nurse, liaison nurse support for practice nurses, and prompts and guidance for patients by means of a personal record card. The study design does not allow the effect of components to be assessed individually. Mosca and colleagues[41] compared patient participation before and after the introduction of a prompt for cardiac rehabilitation in a discharge critical care pathway. An improvement in participation in outpatient cardiac rehabilitation was observed, but this was not statistically significant. Group characteristics were not reported and other factors may have influenced levels of participation. In the study by Scott and colleagues,[111] patients admitted to hospital in three periods were compared. These were before, during and after the dissemination of clinical guidelines and feedback of clinical indicators to health professionals. The cardiac rehabilitation programme was operational during the implementation period and this was used as the baseline period for evaluation. A steady increase in utilisation of the outpatient cardiac rehabilitation service was observed during the implementation period and the authors attribute this to the intervention. However, no comparisons of patient characteristics were available for the relevant periods and, although the authors report that the new cardiac rehabilitation service was fully operational, an increase in uptake might be expected with a new service.

Motivational communications

One study showed significantly increased outpatient cardiac rehabilitation uptake after motivational letters[106] and two showed improved attendance at an outpatient heart group after motivational pamphlets[109] or conversations.[108] In the RCT of Wyer and colleagues,[106] motivational letters were sent to patients at 3 days and 3 weeks postmyocardial infarction. The letters were based on Ajzen and Madden's theory of planned behaviour[107] and designed to influence acceptance and attendance, although the authors noted that

the intervention many have been interpreted as a fear message. Krasemann and Busch[109] described a before-and-after study in which the intervention group received a pamphlet with motivational information about outpatient heart groups as a continuation of inpatient cardiac rehabilitation. Patients in both intervention and comparison groups received the addresses of local outpatient heart groups. The patients receiving the motivational pamphlet were more likely to attend the heart group, but no comparison of baseline characteristics of the patient groups was reported. The RCT of Hillebrand and colleagues[108] evaluated regular contact between a social worker and patients starting at the end of an inpatient cardiac rehabilitation programme. A motivating conversation predischarge and a telephone call after 4 weeks were associated with improved attendance at an outpatient heart group.

Another before-and-after study of an intervention to improve uptake of cardiac rehabilitation was published outside the review time-frame.[112] The intervention comprised a telephone communication about the benefits of cardiac rehabilitation plus assistance in the referral process. The authors reported an increase in enrolment, but the significance of this intervention is not clear, as other between-group comparisons were not described.

Resource implications of interventions to improve uptake of cardiac rehabilitation

Information provided on resource use associated with effective interventions from studies of reasonable quality is summarised in *Table 19*. The interventions can be summarised into three categories: home visits by trained lay volunteers, coordination of referral and postdischarge care by paid liaison nursing staff; and motivational communication letters or pamphlets distributed by paid staff.

Studies provided limited information on the resource inputs required. None provided information on the costs associated with these resource inputs. It was unclear from the information available whether interventions can be implemented by existing staff or require employment of extra staff and, if so, how many. Osika[82] does not specify the number of trained lay volunteers per patient population required to carry out home visits in order to encourage patients' attendance for cardiac rehabilitation. The main cost incurred by the health service is that associated with the one-off training programme provided by the hospital for the lay volunteers. A cardiac rehabilitation coordinator, a counsellor, a resuscitation officer and a safety officer conducted the training, which comprised seven 5-hour sessions. The specific time input of each staff type, however, was not clearly specified, nor was it clear how many lay volunteers were trained over this period. Lay volunteers were reimbursed mileage costs to attend for training and home visits, but these were not quantified.

Similarly, the staff implications of liaison nurse coordination of referral and postdischarge care were unclear. The intervention evaluated by Jolly and colleagues[104] comprised three cardiac liaison nurses who coordinated the referral and postdischarge care of 277 patients over 18 months. This suggests that one nurse could be responsible for coordinating the referral and postdischarge care of 62 patients per annum. It is understood that these liaison nurses were new appointments. Although mentioned in the study, transport costs incurred by the liaison nurse visiting practices and by the practice nurses attending training and support groups were not quantified, nor was the resource input or cost of training the liaison and practice nurses.

The use of motivational letters and pamphlets may require some initial preparation and printing, but at little additional resource input to the standard programme invitation, as these are likely to replace existing letters. Motivational telephone conversations and home visits by social workers will require staff time and transport costs, but these were not quantified in the study by Hillebrand and colleagues.[108]

Further interventions that may improve uptake of cardiac rehabilitation suggested in the literature

The literature review identified a number of suggested interventions for improving uptake of cardiac rehabilitation. Although these potential interventions were not evaluated, the studies provided some evidence to suggest methods meriting further investigation. Examples of interventions excluded from the review at both formal extraction and the earlier inclusion stage, but with possible value in improving uptake, are summarised thematically in *Table 20*.

Discussion

Few studies aimed at improving uptake of outpatient cardiac rehabilitation were found. The

TABLE 19 *Resource implications of interventions to improve uptake of cardiac rehabilitation (only considering period of intervention relating to improving uptake)*

	Staff	Equipment	Consumables	Notes
Lay volunteers				
Home visits by trained lay volunteers and accompaniment to first CR session (Osika, 2001[82])	Multidisciplinary team providing 35 hours training per group of volunteers		Car mileage for seven local visits per patient, training at hospital	Considerable time demands on volunteers
Coordination of referral and postdischarge care				
Liaison nurse encouragement to see practice nurse. Support for practice nurses. Patient-held record card. (Jolly *et al*., 1999[104])	Three cardiac liaison nurses visit both patients and practice nurses		Telephone calls; training for cardiac liaison nurses and practice nurses; car mileage allowance for training and support meetings	The study employed three nurses managing the care of 277 patients in 18 months
Motivational communication				
Telephone and at-home conversations with social worker (Hillebrand *et al*., 1995[108])	Social worker visits patients		Telephone calls; car mileage for one local visit per patient	
Motivational letters designed to increase attendance (Wyer *et al*., 2001[106])	(Support staff; minimal revision of normal practice)		Letters and postage	Letters substitute for existing invitations
Pamphlet with information designed to motivate patients to join outpatient heart groups (Krasemann & Busch, 1988[109])	(Support staff; minimal revision of normal practice)		Pamphlets	

source of studies was diverse with five papers published in peer-reviewed journals, two as theses (the paper by Wyer and colleagues[106] was published after June 2001 but had previously been written as a thesis) and one as a conference abstract. The systematic review identified studies of four types of intervention aimed towards improving uptake of outpatient cardiac rehabilitation and heart groups: written or aural motivational communications, healthcare professional-led interventions at the patient level, coordination of referral and postdischarge care at the service level, and lay volunteers.

The evidence for benefits from motivational communications was reasonably good, with improvements in uptake of outpatient cardiac rehabilitation and heart groups shown in two randomised trials[106,108] and one before-and-after study.[109] Methods of communication used were written letters[106] or pamphlets,[109] or conversation with a health professional.[108]

No conclusions can be drawn on the effectiveness of an intensive home-based nurse-led approach in promoting outpatient cardiac rehabilitation uptake, owing to the limited information in the one report looking at this type of intervention.[110]

A multifaceted approach to the coordination of transfer of care from hospital to general practice including patient self-management was effective in improving cardiac rehabilitation uptake in a randomised trial.[104] Particular aspects of the intervention were not evaluated separately, and it is not possible to compare the relative importance of inpatient nurse contact, professional support of practice nurses and self-empowerment of patients with record cards. Issues relating to study quality limit further support from two non-randomised trials.[41,111]

Regular support and practical assistance from lay volunteers was effective in improving uptake of outpatient cardiac rehabilitation in a non-

TABLE 20 *Further interventions that may improve uptake of cardiac rehabilitation suggested in the literature*

Authors, date	Intervention	Description of report
Non-specific		
Suskin *et al*., 2000[124]	Physician endorsement	RCT. Outcome is intent to participate in CR
Caulin-Glaser & Schmeizel, 2000[123]	Education of health professionals	Before-and-after study. Outcome is referral to CR
Kalayi *et al*., 1999[122]	Computerised referral pathway	Before-and-after study. Outcome is referral to CR
Cannistra *et al*., 1995[128]	Early social services involvement could improve social support and therefore uptake and adherence, by reducing home stress	Prospective study comparing black and white women
Beach *et al*., 1996[71]	Self-care limitations assessment may help to assess, plan and facilitate healthy perceptions and behaviour post-MI and promote CR	Longitudinal interviews
Tack & Gilliss, 1990[129]	Early information and follow-up can improve recovery expectations, give support and promote healthy coping and CR uptake	Prospective, longitudinal interviews
Hershberger *et al*., 1999[130]	Assessment of patient personality type could give a better indicator of compliance, uptake and adherence, and allow professionals to target those most in need	Retrospective study
Alternative methods of provision		
DeBusk *et al*., 1985[131]	Home-based rehabilitation with ECG monitoring	RCT. Comparison of methods of delivery
Lewin *et al*., 1992[132]	Home-based rehabilitation	RCT. Effectiveness
Shaw, 1999[133]	Physiologically monitored exercise and health education over the Internet	Review
Ades *et al*., 2000[134]	Home-based telephone-monitored CR	Trial: group allocation by distance from CR. Comparison of methods of delivery
Roitman *et al*., 1998[135]	Case-management and risk stratification	Review
Bethell & Mullee, 1990[136]	Community-based CR: achieves high patient uptake	RCT. Effectiveness
Pell & Morrison, 1998[51]	Community-based CR: more patient friendly, improving uptake, particularly if run in socially deprived areas	Audit
Contractor *et al*., 2000[137]	Community-based CR: may increase accessibility of services	RCT. Effectiveness
Interventions for women		
Radley *et al*., 1998[57]	Implementing a one-off women-only education session in a CR programme may help to address gender-sensitive issues e.g. returning to sexual relations and housework	Retrospective study
Moore, 1996[138]	Women-specific social support. Strategies to improve social support: better exercise variety and choice, and social opportunities during the programme	Focus-group interviews
Brezinka *et al*., 1998[139]	Women-specific counselling and smaller exercise sessions	Comparative semistructured interviews and questionnaires
Cannistra *et al*., 1992[24]	Provision of childcare/home-help for women attending outpatient CR	Prospective study comparing men and women
Toobert *et al*., 1998[140]	Women's retreat could increase uptake by improving emotional social support and relationships with CR staff	RCT. Effectiveness

randomised trial of demographically similar districts with different service provision.[82]

All authors reported benefit for interventions to improve uptake of outpatient cardiac rehabilitation. This observation should be treated with caution, as it is suggestive of positive publication bias.[141] However, the wide-ranging search of grey literature including conference abstracts and theses should have identified studies considered of limited value for dissemination by authors and publishers. Although it is reasonable

to anticipate some improvement, it is not known how many similar or different interventions have been tried without success and, because unsuccessful, not reported. Similarly, equivocal results relating to cardiac rehabilitation uptake may not have been included in publications of studies with multiple findings. Three of the eight studies included in the review reported substantial material on other outcomes or observations, which would have merited full publication.

It would be inappropriate to draw firm conclusions relating costs to effectiveness of the interventions described in the above studies. Their resource use implications are not clearly described. However, order of magnitude costs may be inferred and these suggest a wide range in implied costs. Motivational interventions need not be costly, as they may replace the existing method of invitation. Individual home visits clearly add to the costs of a service otherwise provided in an outpatient setting. However, more visiting is becoming part of postdischarge care and cardiac rehabilitation. The study by Jolly and colleagues[104] was an evaluation of the introduction of liaison nurses (which would certainly be more costly) and may serve to define their role in supporting patients and other healthcare professionals and coordinating postdischarge care. Incorporation of motivational elements into home visiting may be appropriate, with little further implications for resources.

The literature contained many suggested interventions as facilitators of improved uptake of cardiac rehabilitation, but with no relevant evaluation. At the service level, appropriate education of health professionals and use of discharge care pathways and case management may improve referral and subsequent attendance at rehabilitation.[122–124,135] In a similar vein to the motivational approach of Wyer and colleagues[106] the form of the recommendation to attend may be important, with endorsement by a physician of possible value.[124]

Early support postdischarge by healthcare professionals may be appropriate in promoting cardiac rehabilitation and improving uptake.[128,129] In addition, at an early stage the assessment of patients with regard to self-care limitations and personality type may be helpful in the targeting, planning and optimisation of postdischarge care, including rehabilitation.[71,130]

Home-based programmes are frequently used in the period between hospital discharge and attendance at outpatient cardiac rehabilitation.[142] The home-based programme usually takes the form of a written booklet with an exercise schedule, psychosocial interventions and education relating to risk factor management appropriate for the early stages of recovery. This may serve to maintain patient motivation to lifestyle change in a period with limited contact with health professionals and hence promote later uptake of outpatient rehabilitation services. This merits further evaluation.

Home-based cardiac rehabilitation has also been promoted as a substitute for attendance at an outpatient programme.[131,132] Trials have shown similar effectiveness in risk factor management and patient quality of life after home-based and outpatient methods. Appropriately delivered and assessed home-based cardiac rehabilitation may be a safe and effective form of provision for low- to moderate-risk patients. However, application of the home-based approach as a means to improve the reach of cardiac rehabilitation services should replicate the methods used in the trials of effectiveness and include frequent nurse visits, multidisciplinary input, psychological evaluation and thorough assessment. Patient acceptance of a home-based package does not equate to uptake of cardiac rehabilitation and the demonstration of comparability with an existing service may merely be observation of similar natural recovery in the patient groups. Consequently, home-based rehabilitation is not an appropriate substitute for outpatient services in patients with more severe disease or those with low motivation or lack of interest. It may have value in motivated low- to moderate-risk patients, particularly those living distant from current services. If there is a requirement for monitoring and assessment this could be undertaken using telemedicine approaches, including ECG monitoring and telephone contact during exercise sessions.[131,133,134]

An alternative approach to cardiac rehabilitation provision outside the hospital setting is the use of facilities in the community.[51,136,137] The service provided can be identical to the outpatient programme in content and multidisciplinary nature but avoid features associated with reduced attendance at hospital, including access difficulties. Similarly, factors limiting the uptake of home-based cardiac rehabilitation may be avoided, including reduced reliance on patient self-motivation. Cardiac rehabilitation in a community setting merits evaluation as a method for improving patient uptake and may be particularly valuable in socially deprived areas.[51]

The need to adapt cardiac rehabilitation services to suit female patients has been acknowledged by several authors.[57,128,138–140] Many female patients have a higher level of psychosocial impairment and lower level of physical function than men, and therefore need gender-specific approaches to rehabilitation.[139] Suggested interventions to improve uptake include a women-only education session,[57] appropriate exercise choices,[138] specific counselling,[139] strategies to improve social support,[138] provision of childcare and home-help,[24] and a women's retreat.[140]

There are numerous reports of reasons for non-attendance and under-representation in outpatient cardiac rehabilitation, so it is surprising that the systematic review of published literature identified so few evaluations of interventions to improve uptake. All those found were generic interventions applicable to all patients. The effectiveness of simple targeted interventions to facilitate attendance is not reported in the literature. No evaluations of interventions were reported to address the frequently cited patient reasons for non-attendance of perceived illness, transport difficulties, inconvenient timing or dependent relatives. Transport schemes, non-hospital settings, programmes for specific patient groups (single gender, elderly, ethnic minority groups) and provision of respite care for dependants have been suggested, but not evaluated as possible measures for improving service uptake. It is possible that some programme coordinators have recognised deficits and the need for improvement in services and implemented changes: provision of services for a patient group previously not targeted for rehabilitation is likely to show initial improvement in uptake; but this is a Hawthorne effect which may not be sustained. However, the lack of evidence for benefit found for the use of critical care pathways and the limited evidence for other interventions demonstrate the requirement for good quality RCTs of new methods.

Conclusions

The systematic review of the literature suggests that approaches aimed at motivating patients may be of value in improving the uptake of cardiac rehabilitation. The content of invitation letters, pamphlets and home visits may be used as a vehicle for motivational messages. Some encouragement was also found for use of trained lay visitors in facilitating patient attendance at cardiac rehabilitation. The implied costs of interventions varied widely.

Overall, few trials aimed at improving uptake of cardiac rehabilitation were identified. The need for trials of interventions applicable to all patients and targeting specific under-represented groups is suggested by observational studies.

Chapter 9

Systematic review of interventions to improve adherence to cardiac rehabilitation

Background

Following successful recruitment of patients to a cardiac rehabilitation programme it is important to promote patient adherence to the programme and to maintain associated lifestyle changes. This systematic review aims to assess the effectiveness of methods for increasing patient adherence to cardiac rehabilitation and to suggest areas for further research. For the review adherence was defined as patient attendance at all or the majority of a programme, or maintenance of lifestyle changes associated with cardiac rehabilitation.

Results

Studies included in the review of interventions to improve adherence with cardiac rehabilitation

In Appendix 10 the flow of articles through the review process is shown in accordance with QUOROM.[101] Thirty-eight articles reporting 37 studies identified as relevant to the review of methods to improve adherence to outpatient cardiac rehabilitation and its components were formally included in the review. A broad definition of adherence was applied, with included studies reporting attempts to improve overall programme attendance or compliance with aspects of cardiac rehabilitation. In-depth reading by two reviewers (KR and AB) found 14 studies reporting evaluation of an intervention relating to adherence in an appropriate patient group and with a relevant outcome. Only studies with an explicit statement in their objectives that the intervention under evaluation was designed to promote adherence or those studies with objectives that were explicitly to examine the effects of an intervention on adherence were included in the review.

Studies were characterised by study design and size, the study participants, nature of the intervention, comparison group, principal and other outcomes, and authors' conclusions. A brief summary of studies is presented in *Table 21*, with further details in Appendix 11. Two reports were identified describing the study of Miller and colleagues.[143,144]

Studies excluded from the review of interventions to improve adherence to cardiac rehabilitation

Papers not included in the review are summarised in Appendix 12. Nine out of 23 studies excluded from the review looked at the effectiveness of different rehabilitation formats: home-based cardiac rehabilitation,[73,131,134,158] different intensities or duration of exercise training, [159–161] group counselling[162] or structured teaching.[163] These were not included in the review as they reported effectiveness of interventions with no specific aim at improving patient adherence to cardiac rehabilitation. Thirteen studies had either no relevant outcome[126,164–172] or no comparison group.[173–175] One study presented retrospective data with no indication of how patients came to receive an intervention.[121]

Methodological qualities of studies included in the review of interventions to improve adherence to cardiac rehabilitation

Fourteen studies were identified, of which half were RCTs[145–151] and half were non-randomised studies.[143,144,152–157] One randomised[147] and one non-randomised study[156] reported two distinct interventions. In the non-randomised studies patients were designated to groups by alternate allocation,[143,144,152] before and after implementation of an intervention[154,156,157] and by random allocation with some non-random allocation aimed at increasing numbers in the intervention group.[153] In two studies the allocation to groups was not clearly described.[155,156]

In six studies patients with one specific diagnosis were included and in eight studies less specific selection was applied. Patients represented were myocardial infarction (nine studies), CABG (eight studies), angina (three studies), PTCA (three

TABLE 21 *Studies evaluating interventions to improve adherence to cardiac rehabilitation*

Authors, year and country	Study type and patients	Intervention	Outcome relevant to adherence	Comments
RCTs				
Oldridge & Jones, 1983[145] Canada	RCT, 120 MI, CABG and angina patients	Self-management: agreement to participate in exercise rehabilitation programme signed by patient and coordinator; self-report diary with monitoring of heart rates; questionnaires of daily activities; weight loss and smoking diaries. Progress discussed with coordinator at regular intervals	Attendance at >60% of exercise sessions was 54% in the intervention group and 42% in the control group (not statistically significant)	
Daltroy, 1985[146] USA	RCT, 174 MI, CABG, PTCA and angina patients	Persuasive telephone education intervention to improve patient adherence to exercise regimens. Oral commitment to attend. Spouse telephone counselling	Attendance at exercise sessions by patients was 63.8% in the intervention group and 62.2% in the comparison group (not statistically significant)	
Mahler *et al*., 1999[147] USA	RCT with two intervention groups and one control group, 215 CABG patients	Post-CABG surgery videotape. (1) Mastery: depicts patients as calm and confident, making steady progress with relative ease. (2) Coping: recovery portrayed as steady forward progression of ups and downs	Exercise compliance improved with both interventions compared with controls ($p < 0.02$ to $p < 0.05$). Reduction in dietary cholesterol and saturated fat at 1 month in both intervention groups compared with controls ($p < 0.05$) but not at 3 months	
Aish & Isenberg, 1996[148] Canada	RCT, 104 MI patients	Nursing intervention of nutritional self-care. Food habits assessed and suggestions for changes given with patient commitment. Follow-up telephone calls	Total dietary and saturated fat significantly reduced in the intervention group ($p < 0.01$). Also significant improvements in food habits ($p < 0.05$)	
Ashe, 1993[149] USA	Allocation by form in sealed envelope, 41 MI, CABG, angina, valve problem patients	Motivational relapse prevention during the CR programme: identification of factors interfering with adherence; goals for programme; coping with slips; stressors affecting lifestyle. Also stress management, exercise and relaxation procedure	Total adherence to the maximum number of exercise sessions was 90% in the intervention group and 89% in the control group (not significant)	

continued

TABLE 21 *Studies evaluating interventions to improve adherence to cardiac rehabilitation (cont'd)*

Authors, year and country	Study type and patients	Intervention	Outcome relevant to adherence	Comments
Hopper, 1995[150] USA	RCT, 80 MI, CABG, angioplasty patients	Monthly telephone contact by a cardiac nurse or exercise physiologist to promote exercise, healthy diet, medication usage, risk factor knowledge and identification of symptoms	No difference between groups in exercise habit or intention to exercise. Conditions that facilitated the performance of exercise were improved in the intervention group compared with control ($p < 0.05$)	Losses to follow-up of 45% in the intervention group and 47% in controls
Duncan *et al*., 2001[151] USA	RCT, eight heart failure patients	Behavioural feedback intervention on dietary sodium intake. Discussion of problem-solving strategies to reduce sodium intake	Sodium intake was significantly less in the intervention group (1569 vs 2836 mg, $p < 0.05$)	Small feasibility study, four patients in each group
Non-randomised studies				
Leslie & Schuster, 1991[152] USA	Alternate allocation, 30 MI, CABG, angioplasty, coronary disease patients	Written exercise contract negotiated with the patient. On completion of the contract patients received a reward	No significant difference in attendance in intervention (90%) and control (89%). Significant increase in exercise knowledge in the intervention group	
Miller *et al*., 1988,[143] 1989[144] USA	Alternate allocation, 115 MI patients	Nurse intervention to improve medical regimen. (1) Assessment: attitudes and regimen compliance. (2) Problem identification. (3) Goal setting	No significant differences in health behaviour and attitude scales	Repeated self-evaluation questionnaires and visits may have acted as intervention in control group
Lack, 1985[153] USA	Part random, part non-randomised, 48 CHD, MI, CABG patients	Insight-orientated group psychotherapy. Supportive, cooperative and goal directed. Highlight and promote change in non-compliance with physician recommendations	Self-report measures of compliance 2.57 for intervention and 2.37 control groups (not significant). Intervention group attended 88.4% of the prescribed exercise sessions compared with 75.7% in the control group ($p < 0.05$)	
Marshall *et al*., 1986[154] USA	Patients seen in different periods, 60 CABG patients	Nurse-led structured teaching programme to increase patients' knowledge and compliance to medication, diet, smoking cessation and exercise	Overall compliance score assessed by self-report was 86.8 in the intervention group, and 79.5 in the control group ($p < 0.05$). Compliance better in intervention than control group for activity (15.6 vs 7 blocks walked, $p < 0.005$)	
Huerin *et al*., 1998[155] Argentina	Non-randomised study, 509 CHD patients	Adherence strategy with signed commitment to rehabilitation, family involvement, sports, recreational activities and talks	Attendance at ≥ 66% sessions. RR 2.3 (95% CI 1.8 to 2.9) at 12 weeks, 2.9 (2.3 to 3.7) at 24 weeks, 4.25 (3.2 to 5.6) at 52 weeks (log-rank test between strategies, $p < 0.001$)	No information on group allocation

continued

TABLE 21 *Studies evaluating interventions to improve adherence to cardiac rehabilitation (cont'd)*

Authors, year and country	Study type and patients	Intervention	Outcome relevant to adherence	Comments
McKenna *et al.*, 1998[156] UK	(1) Non-randomised study. (2) MI patients compared with historical controls	(1) Low-intensity exercise for patients unable to take part in standard exercise owing to co-morbidity. (2) Women-only groups	Attendance was 82% in the low-intensity exercise group and 34% in the standard rehabilitation comparison group. Significance not assessed as patient numbers not reported. Attendance in the women-only group was 75%, compared with 6% historically	Patient numbers not reported. The magnitude of changes cannot be assessed
Erling & Oldridge, 1985[157] Canada	Before-and-after study, 90 CHD patients	Spouse support in outpatient CR. Compares baseline before spouse participation, patients with spouse participation and patients with no spouse participation	Attendance increased from 44% to 90% for programme with spouse participation ($p < 0.001$), and 67% for programme with no spouse participation ($p < 0.05$)	

RR, relative risk.

studies), heart failure (one study), valve replacement (one study) and non-specific coronary heart disease (four studies).

In eight studies (two randomised) the outcome was attendance at exercise sessions.[145,146,149,152,153,155–157] In six studies (four randomised) the outcome was questionnaire assessment of diet or exercise behaviours to determine compliance with lifestyle changes.[143,144,147,148,150,151,154]

The method of randomisation was described in two of the seven RCTs[145,146] and blind outcome assessment in one randomised study.[146] None of the seven non-randomised studies reported blind outcome assessment. Baseline characteristics of intervention and comparison groups were described in three randomised trials,[146,148,150] and in one trial patients were stratified by factors predictive of dropout from cardiac rehabilitation.[145] In five non-randomised studies baseline characteristics of patients were reported.[143,144,152–155] Eight studies provided information on losses to follow-up.[143–147,149,150,152,153] In one randomised study loss to follow-up was particularly high at 45–47%.[150]

Themes identified from the review of interventions to improve adherence to cardiac rehabilitation

Interventions to improve adherence to cardiac rehabilitation or elements of the rehabilitation process were varied and frequently multifaceted. However, five general themes are apparent: formal patient commitment, spouse or family involvement, strategies to aid self-management, education, and psychological intervention. Studies with more than one component are included in each appropriate theme.

Formal patient commitment

In four studies an agreement between the patient and the programme staff was a key element of the intervention.[145,146,152,155] In the trial of Leslie and Schuster[152] the intervention was solely a written contingency contract with rewards for successful completion of attainable exercise behaviours. Patients were allocated alternatively to intervention and comparison groups, which were reasonably well matched. Attendance rates at exercise sessions were similar in the two groups, although patients in the contract group showed a significant increase in exercise knowledge compared with controls. Overall participation at exercise sessions was notably high (90%). In the RCT of Oldridge and Jones,[145] a self-managed adherence promoting strategy incorporating signed commitment was associated with a non-significant improvement in attendance at an exercise rehabilitation programme. Huerin and colleagues[155] reported a significant increase in cardiac rehabilitation attendance in patients receiving an adherence-promoting strategy with signed agreement, but little information was presented on the allocation of patients to groups. Daltroy[146] reported an RCT in which oral commitment was included in a

persuasive telephone intervention to improve patient adherence to an exercise programme. No improvement in attendance was seen in patients receiving the intervention.

Spouse or family involvement

Three studies included an intervention directed at the patient's spouse or family.[146,155,157] Erling and Oldridge[157] reported a before-and-after study in which a spouse support programme was associated with significantly increased patient attendance at a cardiac rehabilitation programme. The authors showed no baseline comparisons of the two groups. In the RTC of persuasive telephone education, Daltroy[146] provided telephone counselling to patient spouses. No improvement in attendance was associated with the intervention. Family involvement was also a component of the adherence strategy of Huerin and colleagues.[155] Improved outpatient cardiac rehabilitation attendance was observed, but lack of information on group allocation limits the value of the study.

Strategies to aid self-management

Five studies reported interventions based on self-management techniques.[143–145,148,149,151] In the RCT of Oldridge and Jones,[145] as well as signed agreement, patients completed and received feedback on self-report diaries of heart rate, daily activities, weight loss and smoking habit. The intervention was associated with a non-significant increase in attendance at the exercise rehabilitation programme. Aish and Isenberg[148] reported an RCT of nutritional self-care based on the model of Orem,[176] in which patients had food habits assessed and individualised nutritional goals set. Significant improvements in dietary variables were achieved in the self-care patients. A similar programme of assessment, problem identification and goal setting was assessed in a trial by Miller and colleagues,[143,144] in which patients were allocated alternatively to intervention and control after completion of a course of inpatient rehabilitation. Regimen compliance measured by health behaviour and attitude scales did not differ between groups. The authors noted that the frequent completion of self-evaluation questionnaires and data collection visits by nurses may have served as an effective intervention in the control group. In the thesis by Ashe[149] an apparently randomised approach was used to evaluate a motivational relapse prevention programme, based on Marlatt and Gordon's model,[177] for patients after an outpatient cardiac rehabilitation programme. Patients were allocated to groups according to the forms contained in sealed envelopes. As with other self-management interventions this included assessment, problem identification and goal setting. Adherence to exercise was similar in the intervention and control groups. However, it should be noted that the control patients received an intervention which, although not designed as a motivational programme, did provide patients with an equivalent number of extra sessions of exercise education. A small RCT described by Duncan and colleagues[151] applied self-management and behavioural feedback methods to the control of sodium intake. Heart failure patients attending a cardiopulmonary rehabilitation programme were randomised to receive an intervention with assessment of sodium intake, discussion of problem-solving strategies and follow-up. Patients receiving the intervention had a significantly reduced sodium intake.

Educational intervention

Four studies of educational interventions aimed at improving adherence to components of cardiac rehabilitation were identified.[146,147,150,154] The RCT reported by Daltroy included an educational intervention in the form of telephone counselling.[146] This was designed as a persuasive communication with emphasis on the benefits of exercise, realistic expectations of recovery and coping methods. Attendance at exercise programmes was not improved in the group with the educational intervention. In the RCT of Mahler and colleagues[147] patients were shown educational videotapes before discharge from hospital. The tapes provided information regarding recovery delivered by a healthcare expert. Compliance with exercise and dietary advice measured by questionnaire was increased in patients receiving the intervention. The authors suggest that presenting the information in a format describing a realistic coping approach to recovery may be beneficial. Hopper[150] described an RCT of regular educational and supportive telephone calls. Although no difference was shown in exercise behaviour between groups, those patients receiving the supportive educational intervention did report improvement in conditions facilitating the performance of exercise. Marshall and colleagues[154] compared the effect of nurse-led structured and non-structured postoperative teaching in two consecutive groups of patients. Patient characteristics and risk factors were similar in the two groups. Measures of compliance based on self-report of activity, smoking, and a composite of activity, smoking, diet and medications were improved in the structured teaching group.

TABLE 22 *Resource implications of interventions to improve adherence to cardiac rehabilitation*

	Staff	Equipment	Consumables	Notes
Strategy to aid self-management				
Nursing intervention of nutritional self-care (Aish & Isenberg, 1996[148])	Nurse	Telephone	One visit in hospital and local visit; three telephone calls per patient; dietary records	
Behavioural feedback on dietary sodium (Duncan *et al*., 2001[151])	Nurse		Two interviews during outpatient rehabilitation; dietary records	
Educational intervention				
Post-CABG surgery videotape (Mahler *et al*., 1999[147])		Video recording and player		Video shown in hospital before discharge

Psychological intervention

One intervention describing a specifically psychological intervention was identified.[153] Lack[153] describes an insight-orientated group psychotherapy intervention in a partially randomised study. The randomised group was augmented with non-randomised patients if there were insufficient numbers to form an intervention group. For the intervention patients were encouraged to communicate thoughts and feelings and to promote changes in behaviours likely to affect recovery. Self-report and physiological markers of compliance to exercise were little changed by the intervention. However, there was a significantly higher attendance at exercise sessions in the patients receiving the psychotherapy intervention.

Other interventions

Two reports described interventions that did not fit into the above themes.[155,156] McKenna and colleagues[156] reported that attendance was increased after implementation of women-only and low-intensity exercise programmes. Numbers in comparison groups and patient characteristics were not reported. In the study by Huerin and colleagues[155] recreational activities and sports were included in the adherence strategy. Again, the reporting precludes any assessment of value.

Resource implications of interventions to improve adherence to cardiac rehabilitation

Information provided on resource use associated with effective interventions from studies of reasonable quality is summarised in *Table 22*. The interventions can be summarised into two categories: strategies to aid self-management, and educational interventions. Studies provided limited information on the resource inputs and no information on the costs associated with these resource inputs.

It is unclear whether the strategies to aid self-management can be implemented by existing staff or require the employment of extra staff and, if so, how many. The intervention described by Aish and Isenberg[148] consisted of two interviews with a nurse for dietary assessment and three follow-up telephone calls by a nurse for each patient. The first interview was conducted in hospital and the second at a home visit. Duncan and colleagues[151] evaluated a similar intervention, but in their study both interviews were conducted during outpatient cardiac rehabilitation sessions. In both studies patients were also required to complete a 3-day dietary intake log. The videotape intervention of Mahler and colleagues[147] was provided in hospital before discharge. After initial preparation of educational material the main resource input of the intervention would be the appropriate audiovisual equipment.

Further interventions that may improve adherence to cardiac rehabilitation suggested in the literature

The literature review identified a number of suggested interventions for improving adherence to cardiac rehabilitation. Although these potential interventions were not evaluated, the studies provided some evidence to suggest methods meriting further investigation. Examples of interventions excluded from the review at both formal extraction and the earlier inclusion stage, but with possible value in improving uptake, are summarised thematically in *Table 23*.

TABLE 23 *Further interventions that may improve adherence to cardiac rehabilitation suggested in the literature*

Authors, year	Intervention	Purpose of study
Non-specific		
McGee & Horgan, 1992[54]	Former patients as models may help to promote adherence	Audit
Tooth & McKenna, 1996[178]	Strategy to improve self-efficacy. Patient modelling on video and audiotape and in leaflets. Patients view other patients (e.g. healthy meal preparation)	Review
Koikkalainen *et al*., 1996[179]	Social skill and taste-training may remove barriers to a healthy lifestyle	Structured interviews
Knapp & Blackwell, 1985[180]	Offering specific and practical assistance for spouses (e.g. menus and recipes) to help improve, lifestyle change	Review
Edgren, 1998[181]	Hydrotherapy as part of the exercise component. To increase self-training patients attend a gym and/or hydro session weekly	Generic case study and interviews
Lee *et al*., 1996[161]	Lower intensity exercise programme	RCT of effectiveness
Oldridge, 1984[182]	Vary programme and include swimming and different exercise equipment	Review
DeBusk *et al*., 1994[183]	Case management and risk stratification. A more individualised package of care may lead to improved adherence	RCT of effectiveness
Roitman, *et al*., 1998[135]		Review
Hoepfel-Harris, 1980[184]	Provide classes at convenient times, including before work and evenings	Review
Comoss, 1988[185]		Review
Emery, 1995[186]		Review
Interventions for women		
Radley *et al*., 1998[57]	A one-off women-only education session may help to address gender-sensitive rehabilitation issues	Retrospective study
Moore & Kramer, 1996[187]	Women-specific social support, exercise variety and choice, and social opportunities	Focus-group interviews
Brezinka *et al*., 1998[139]	Women-specific counselling and smaller exercise sessions	Comparative semistructured interviews and questionnaires
Toobert *et al*., 1998[140]	Women's retreat to improve emotional social support and relationships with cardiac rehabilitation staff	RCT of effectiveness
Cannistra *et al*., 1992[24]	Provision of childcare or home-help for women attending cardiac rehabilitation	Prospective comparison study of men and women
Interventions for the elderly		
Allen & Redman, 1996[188]	Awareness of elderly-specific hindrances. Shorter education sessions with less information run at a slower pace	Review
Interventions for ethnic groups		
Caulin-Glaser & Schmeizel, 2000[123]	Take account of cultural and racial differences when attempting to improve diet and exercise habits. African–American males showed fewer improvements in diet than Caucasians	Prospective observational study
Eftekhari *et al*., 2000[189]	Translation and presentation of educational material for Asian patients	Programme description

Discussion

Information came from journals (seven studies), theses (three studies) and conference abstracts (four studies). It was disappointing to find that some evaluations of potentially valuable methods to improve adherence to outpatient cardiac rehabilitation and its components were only found in the grey literature, with little chance of being read by health professionals.

Systematic review of the literature identified five main intervention themes: formal patient commitment, spouse or family involvement, strategies to aid self-management, education, and psychological therapy.

The review of the literature gave little support to the use of written and oral commitments to promote exercise adherence. The one study looking exclusively at written contracting showed

no effect using a non-randomised design.[152] Attendance in both intervention and control groups was high at about 90%. A randomised trial of a self-management programme incorporating signed agreement to participate as an adjunct to an exercise rehabilitation programme showed a non-significant improvement in attendance.[145] The small benefit cannot be attributed entirely to written communication as the intervention included several other self-management approaches. Similarly, in a study of persuasive intervention by telephone with additional spouse counselling, oral commitment constituted one part of the intervention.[146] No improvement in attendance was attributed to this package of measures. One further study provided little methodological information to substantiate an observed improvement in cardiac rehabilitation after an adherence strategy incorporating signed commitment.[155] Overall, the value of formal commitment in promoting adherence to cardiac rehabilitation is not supported by evidence from the literature. The identification of only one study looking specifically at written agreement to participate, but in which attendance was uniformly high in intervention and comparison groups may suggest the need for more trials. However, it is probable that the use of written and oral commitment has better application in the promotion of outpatient cardiac rehabilitation uptake rather than adherence.

Evidence for the benefit of spouse or family involvement in increasing rehabilitation adherence was limited by the designs of studies. One study looking specifically at a spouse support programme provided no information on baseline characteristics or group allocation.[157] In another randomised study telephone counselling for spouses was provided in addition to a more intensive patient counselling intervention, but no improvement in attendance was observed.[146] Another study incorporated family involvement into an adherence-promoting strategy, but little information on the design or conduct of the study was reported.[155] None of these studies addressed specifically the issue of spouse or family involvement in promoting rehabilitation attendance in an adequately designed trial. Evidence for the effectiveness of counselling and support in helping spouses and families to cope with patient illness suggests that interventions may have value other than in promoting adherence to cardiac rehabilitation.[144,190]

Studies reporting strategies to aid self-management aimed at improving adherence to rehabilitation goals give some suggestion of benefit. In a randomised trial of self-evaluation and information feedback on exercise and risk factors a non-significant improvement in attendance at rehabilitation was observed.[145] In this trial patients were also asked for written commitment. Another randomised trial reported improvements in dietary habits,[148] and a small, randomised trial showed reduced sodium intake after individualised assessment and goal setting.[151] However, two trials, one randomised[149] and the other with non-random allocation to groups,[143,144] suggested no benefit for assessment and goal setting in improving health behaviours or exercise adherence. The authors noted that control patients in these studies received regular self-evaluation questionnaires and nurse visits for data collection[143,144] or an educational intervention unrelated to self-management,[149] which may have affected outcomes. In trials a repeatedly administered evaluation tool may act as an intervention. In conclusion, the uses of appropriate techniques promoting self-management in specific areas of rehabilitation are at least worthy of further study.

Studies of educational interventions to improve adherence to components of cardiac rehabilitation gave little encouragement. No benefits of education and counselling on attendance at an exercise programme were seen in two RCTs using telephone interventions.[146,150] A predischarge videotaped educational intervention was effective in improving exercise and dietary compliance.[147] Although this may be of benefit in the early phases of rehabilitation it is likely to have limited value in the promotion of adherence to outpatient cardiac rehabilitation. However, the study did suggest that presentation of information in a format describing recovery based on a coping approach may be most effective. The importance of the method of dissemination of educational information was also suggested by a before-and-after study showing benefit for a structured teaching approach.[154]

One partially randomised study reported a psychological intervention aimed at improving exercise adherence.[153] Although no significant improvement in self-reported exercise was observed, the patients receiving a 12-week psychotherapy intervention attended more cardiac rehabilitation exercise sessions. This improved attendance may be a consequence of the psychological features of the intervention or of the extra requirement to attend the rehabilitation centre. The lack of an effect on self-reported exercise tends to support the latter.

Two studies reported other approaches to improving adherence. These were the inclusion of recreational activities and sports in the programme[155] and the introduction of outpatient cardiac rehabilitation designed specifically for women.[156] Little can be learned from either study as insufficient information on patients and study methods was reported.

Little information on the costs associated with effective interventions can be inferred from the published reports. One can do little more than guess the time commitment of nursing staff to undertake these extra tasks. Strategies to improve patient self-management, such as dietary assessments, could be incorporated into outpatient cardiac rehabilitation session and may therefore not require home visits. Nurses would still require training in the evaluation of diet and the analysis of questionnaire data, and this may serve to formalise assessment and procedures already in place in cardiac rehabilitation.

With respect to the educational intervention, videos are frequently used to provide information to patients before discharge, and presentation of information in an alternative delivery format would not have resource implications. However, initial preparation or purchase of appropriate educational videos would be required.

Outside those trials aimed at improving adherence to cardiac rehabilitation several interventions have been suggested but not evaluated. These include more approaches based around improvements in patient self-efficacy. The inclusion in programmes of previous patients or representation on video of behaviour of model patients showing appropriate lifestyle change (e.g. relating to food preparation) may be a useful format for delivery of information.[54,178] Similarly, practical demonstration that a healthy diet can be palatable and enjoyable may be a method to promote adherence to dietary change.[179] In these areas of intervention the involvement of spouses may be appropriate.[180]

Alternative forms of exercise, including swimming,[182] hydrotherapy[181] and lower intensity training,[161] may be worthy of evaluation in improving adherence to rehabilitation. Programmes with lower exercise intensities may be more likely to achieve maximum attendance,[161] but an extended length programme may be required to maintain benefits.[144] Slower paced and less detailed sessions may be appropriate in the provision of educational information to elderly patients.[188]

Women patients may prefer different kinds of exercise to men and be more likely to adhere to rehabilitation other than treadmill and cycle.[187] Other interventions that may improve adherence by women patients suggested in the literature include education, counselling and social support addressing issues specific to women's recovery.[57,139,187] Provision of childcare or home-help for women attending cardiac rehabilitation may improve adherence.[24]

Taking into account cultural and racial differences in the promotion of exercise and diet may help to improve adherence by ethnic groups to rehabilitation.[123] Translation of educational materials and presentation in an appropriate way may improve adherence in ethnic minority groups.[189]

Other forms of rehabilitation based around risk stratification and case management are suggested as methods to improve patient adherence,[135,183] but the effectiveness of this approach compared with outpatient rehabilitation with appropriate outcome measures is not known. Similarly, provision of support at a women's retreat may serve to promote lifestyle change, although its effectiveness as an adjunct to outpatient care has not been evaluated.[140]

Providing classes at times to suit patients may improve adherence to cardiac rehabilitation. Patients may find it easier to attend classes timed before work and in the evening.[184–186]

The systematic review of the literature found few studies of sufficient quality to make specific recommendations of methods to improve adherence to outpatient cardiac rehabilitation and its components. The most promising approach was the use of self-management techniques based around individualised assessment, problem solving, goal setting and follow-up. This is most likely to be effective in improving specific aspects of rehabilitation, including exercise and diet. Further investigation of this approach may be best carried out by a systematic review of self-management interventions in less specific patient groups than considered here. Patient commitment to attend did not suggest benefit in the promotion of adherence to aspects of outpatient cardiac rehabilitation, but may be useful in improving uptake of rehabilitation. Other interventions identified in the literature may already be standard practice: use of educational video and classes, and psychological support are features of the modern rehabilitation programme. Similarly,

spouse and family support may be provided as an adjunct to a rehabilitation programme for reasons unrelated to patient adherence.

Perhaps the most disappointing outcome of the review is the dearth of literature reporting the evaluation of simple interventions aimed at improving adherence to cardiac rehabilitation for all patients or specific groups of patients. No interventions were reported to address the frequently cited patient reasons for non-adherence of perceived recovery, illness, transport difficulties, inconvenient timing or care of dependent relatives. Similarly, no evaluations were identified of programmes designed to improve adherence for specific patient groups frequently under-represented in outpatient cardiac rehabilitation (including women, the elderly and ethnic minority groups). The lack of published studies may reflect an under-appreciation by both rehabilitation staff and journal editors of the value of trials in evaluating new interventions to improve adherence to cardiac rehabilitation. Surveys and audits suggest that programme coordinators may recognise deficits and the need for improvements in services and implement changes to provision without formal evaluation. The ineffectiveness of several types of intervention to improve adherence to cardiac rehabilitation identified in this systematic review demonstrates that innovations in services should be tested in well-designed studies.

Conclusions

The systematic review identified few studies of sufficient quality to assess the effectiveness of interventions to improve adherence to cardiac rehabilitation. Half of the studies found were in sources outside the mainstream of medical literature.

Self-management techniques suggested some value in the promotion of specific aspects of lifestyle change and a further review in a broader context of health and disease may be appropriate. Educational interventions aimed at improving adherence gave equivocal results and suggest that the format of the intervention merits further study.

Observational studies identify many areas where interventions may serve to improve patient adherence to cardiac rehabilitation, and surveys and audits show that interventions have already been implemented. The systematic review of the literature suggests that, before implementation, interventions should be evaluated in well-conducted studies with economic assessment, and the results disseminated widely and reviewed regularly.

Chapter 10

Systematic review of interventions to improve professional compliance with cardiac rehabilitation

Background

Barriers to attendance at and adherence with outpatient cardiac rehabilitation associated with service factors have been identified. However, the effectiveness of interventions to improve professional compliance with the provision of cardiac rehabilitation has not been assessed by systematic review. This systematic review aims to assess the effectiveness of methods for increasing professional compliance with cardiac rehabilitation and to identify areas meriting further research. The review includes interventions to encourage healthcare professionals to comply with guidelines or good practice regarding invitation and support of patients' cardiac rehabilitation.

Results

Studies included in the review of interventions to improve professional compliance with cardiac rehabilitation

Eighteen articles reporting 17 studies were identified as relevant to the review of methods to improve professional compliance with cardiac rehabilitation and were formally included in the review. Reading by three reviewers (SE, FT and AB) found six studies reporting evaluation of an intervention relating to an appropriate patient group and with a relevant outcome. The flow of articles through the review process is shown in accordance with QUOROM in Appendix 13.[101] Studies were characterised by type and size, participants, intervention, comparison group, principal and other outcomes, and authors' conclusions.

A brief summary of studies is presented in *Table 24*, with further details in Appendix 14. More than one report was identified from the trial of Jolly and colleagues[102–104] and the reference providing the main source of information for the systematic review is cited in the tables and text.

Studies excluded from the review of interventions to improve professional compliance with cardiac rehabilitation

Eleven studies selected for data extraction but not included in the review are summarised in Appendix 15. More than one report was identified from the trial of Campbell and colleagues.[125,126] The excluded studies either had no relevant outcome data,[116,117,125–127,164,171,191] provided only descriptions of services with no outcomes[119,175,192] or were retrospective in design.[116]

Methodological qualities of studies included in the review of interventions to improve professional compliance with cardiac rehabilitation

Six studies were identified that evaluated interventions to improve professional compliance with cardiac rehabilitation. Two reported RCTs. In one trial randomisation was on an individual basis,[124] but no other information on the method of randomisation, blind outcome assessment or baseline characteristics of groups was reported. In the other trial patients were randomised by general practice.[104] The authors of this trial described methods of randomisation, blind outcome assessment and baseline characteristics of groups. Loss to follow-up was low in this study. None of the other studies reported loss to follow-up. Four studies described outcomes in periods before and after implementation of an intervention.[41,111,122,123] Baseline group characteristics for appropriate periods were not reported in any of these studies.

In three studies the outcome was attendance,[41,104,111] in two referral[122,123] and in one patient commitment to attend cardiac rehabilitation.[124] Four studies included only myocardial infarction patients.[41,111,122,124] One study included myocardial infarction and angina patients[104] and another only post revascularisation patients.[123]

TABLE 24 *Studies evaluating interventions to improve professional compliance with cardiac rehabilitation*

Authors, year and country	Study type and patients	Intervention	Findings relevant to uptake	Comments
RCTs				
Jolly *et al.*, 1999[104] UK	Cluster RCT, 67 general practices, 597 MI and angina patients	Liaison nurse supports practice nurses and encourages patients to see practice nurse after discharge. Patient-held record card to prompt and guide follow-up	42% of patients in the intervention group attended at least one outpatient CR session compared with 24% of controls ($p < 0.001$)	Multifaceted intervention. Management of patients in control practices not explicit
Suskin *et al.*, 2000[124] Canada	RCT, 50 patients	Attending physician provides written endorsement	62% of patients in the intervention group gave commitment to participate in CR compared with 38% in the control group ($p = 0.08$)	Abstract only
Non-randomised studies				
Kalayi *et al.*, 1999[122] UK	Before-and-after study, 561 MI patients	Electronic referral pathway with feedback to ward staff on referral rates	After intervention referral increased from 194/298 (65%) to 208/263 (79%) ($p = 0.0002$)	Disparity between long-term and short-term referral rates
Mosca *et al.*, 1998[41] USA	Before-and-after study, 199 MI patients	Prompt for outpatient CR in discharge critical care pathway	Critical care pathway associated with a non-significant increase in outpatient CR participation (OR 1.9, 95% CI 0.6 to 5.5)	No baseline group comparisons
Caulin-Glaser & Schmeizel, 2000[123] USA	Before-and-after study. Post-revascularisation patients. Patient numbers not specified	Educational intervention for healthcare providers on the comprehensive nature and benefits of CR. Instructions for nurses to discuss CR with patients and encourage discussion of referral with physicians	In-hospital referral increased by 50% ($p < 0.05$). Physician office referral increased by 61% ($p < 0.05$)	Abstract only
Scott *et al.*, 2000[111] Australia	Before-and-after study, 649 MI patients	Dissemination of clinical guidelines to hospital staff and general practitioners. Feedback on clinical indicators	After intervention outpatient CR utilisation increased from 24% to 54% ($p = 0.003$)	Baseline period corresponds to CR programme start-up

Themes identified from the review of interventions to improve professional compliance with cardiac rehabilitation

Three themes of interventions were identified in the systematic review: improvement of the referral process, coordination of transfer of care, and physician endorsement.

Improvement of referral process

Four studies were identified that evaluated methods to improve the referral process.[41,111,122,123] In a study comparing periods before and after the introduction of an electronic referral pathway Kalayi and colleagues[122] observed a significant increase in patient referral to cardiac rehabilitation. The intervention was initiated with a referral section on the electronic patient record of patients discharged with a diagnosis of myocardial infarction. Subsequently, feedback on referral was given to ward staff. No information on group characteristics before and after intervention was provided and large differences between monthly and longer term referral rates suggest the presence of other sources of referral variability. Mosca and colleagues[41] compared patient participation before and after the introduction of a

TABLE 25 *Resource implications of intervention to improve professional compliance with cardiac rehabilitation*

	Staff	Equipment	Consumables	Patient costs
Coordination of postdischarge care				
Liaison nurse support for practice nurses (Jolly *et al.*, 1999[104])	Three cardiac liaison nurses		Training for cardiac liaison nurses and practice nurses	The study employed three nurses involving a total of 277 patients in 18 months

prompt for cardiac rehabilitation in a discharge critical care pathway. An improvement in participation in outpatient cardiac rehabilitation was observed, but this was not statistically significant. Group characteristics were not reported and other factors may have influenced levels of participation. Caulin-Glaser and Schmeizel[123] reported the implementation of an educational intervention for healthcare providers. Information on cardiac rehabilitation, including its comprehensive nature and benefits, was given to medical and nursing staff and on health outcomes and cost-effectiveness to members of the clinical cardiology council. After the intervention both in-hospital and physician office referral were significantly increased. Again, no baseline information to assess comparability of patient groups was provided. In the study of Scott and colleagues[111] patients admitted to hospital in three periods were compared. These were before, during and after the dissemination of clinical guidelines and feedback of clinical indicators to health professionals. The cardiac rehabilitation programme was operational during the implementation period and this was used as the baseline period for evaluation. A steady increase in utilisation of the outpatient cardiac rehabilitation service was observed during the implementation period and the authors attribute this to the intervention. However, no comparison of patient characteristics was available for the relevant periods and, although the authors report that the new cardiac rehabilitation service was fully operational, an increase in uptake might be expected with the new service.

Coordination of postdischarge care

Jolly and colleagues[104] reported a cluster RCT of coordination of care of myocardial infarction and angina patients between hospital and general practice by specialist cardiac liaison nurses. Attendance at one or more cardiac rehabilitation sessions was significantly increased in the intervention patients. The intervention consisted of three main elements: liaison nurse support for practice nurses, liaison nurse encouragement for patients to see the practice nurse, and prompts and guidance for patients by means of a personal record card. The study design does not allow the effect of components to be assessed individually.

Physician endorsement

Suskin and colleagues[124] conducted an RCT comparing attending physician cardiac rehabilitation endorsement with a generic endorsement. The intervention was associated with a non-significant increase in patient-reported intent to participate in cardiac rehabilitation. No benefit was observed for in-person delivery of the endorsement. Little information on the conduct of the trial or patient characteristics was reported and the outcome of intention to attend is somewhat removed from actual attendance at cardiac rehabilitation.

Resource implications of intervention to improve professional compliance with cardiac rehabilitation

Information provided on resource use associated with the only effective intervention of reasonable quality is summarised in *Table 25*. As described earlier, in the study by Jolly and colleagues[104] three liaison nurses were employed with responsibility for the coordination of postdischarge care of 277 patients over 18 months, a yearly average of 62 patients per nurse. Transport costs incurred by liaison nurses visiting practices and by the practice nurses attending training and support groups were not quantified, nor was the resource input or cost of training liaison and practice nurses.

Further interventions that may improve professional compliance with cardiac rehabilitation suggested in the literature

The literature review identified a number of suggested interventions for improving professional compliance with cardiac rehabilitation. Although these potential interventions were not evaluated the studies provided some evidence to suggest methods meriting further investigation. Examples

TABLE 26 *Further interventions that may improve professional compliance with cardiac rehabilitation suggested in the literature*

Authors, year	Intervention	Purpose of study
Parks *et al*., 2000[32]	Appointment of CR programme director to lead, audit and commission appropriate resources	Audit
Parks *et al*., 2000[32]	Programme run in accordance with national guidelines	Audit
Young & Kahana, 1989[46] Bittner *et al*., 1999[37]	Physicians and insurers educated on benefits for patient groups	Retrospective observational Retrospective observational
Comoss 1988[185]	Referring physicians involved in programme	Review
Stokes, 2000[193]	Education for CR coordinators and staff	Review
Parks *et al*., 2000[32]	Explicit criteria for CR eligibility	Audit
King & Teo, 1998[194]	Streamlining of referral	Review
Parks *et al*., 2000[32]	Centralised CR attendance and contact records	Audit
Levknecht *et al*. 1997[116]	Clinical pathway and clinical quality improvement tool	Programme description
Cannistra *et al*., 1995[128]	Early social services involvement to improve social support and hence uptake of CR	Prospective comparison
Effron *et al*., 1986[195]	CR commenced earlier	Retrospective observational
Roitman *et al*., 1998[135]	Removal of time restriction for start of programme	Review

of interventions excluded from the review at both formal extraction and the earlier inclusion stage, but with possible value in improving professional compliance, are summarised thematically in *Table 26*.

Discussion

The healthcare professional has a pivotal role in recruitment of patients to cardiac rehabilitation, and their contribution is dependent on education, compliance with guidelines and coordination of services. Few studies aimed at improving professional compliance with outpatient cardiac rehabilitation were found. Three studies were published in peer-reviewed journals and three as conference abstracts.

Evaluations of three types of intervention were identified by systematic review: improvement of the referral process, coordination of postdischarge care, and physician endorsement of cardiac rehabilitation.

None of the four studies reporting interventions to improve the referral process included adequate methodological information. The use of a before-and-after study design might have provided some evidence on the effectiveness of interventions, but the lack of group comparisons and programme factors influencing patient attendance precludes this. This is disappointing, as the inclusion of cardiac rehabilitation in a critical care pathway effective in promoting discharge medication is appealing. Similarly, improving referral by dissemination of clinical guidelines and subsequent feedback of clinical indicators to health professionals merits further evaluation.

A multifaceted approach to the coordination of transfer of care from hospital to general practice including liaison nurse support for practice nurses was effective in improving cardiac rehabilitation uptake in a randomised trial. Particular aspects of the intervention were not evaluated separately, and it is not possible to compare the relative importance of professional support of practice nurses, in-hospital nurse–patient contact and self-empowerment of patients with record cards. The possibility of referral of patients from general practice suggests that the involvement of practice nurses may be of particular value in the referral of angina patients who have not been admitted to hospital.

The value of physician endorsement in encouraging patient participation in cardiac rehabilitation was not confirmed. However, some support for further evaluation is suggested by the randomised trial of Suskin and colleagues,[124] where a non-significant tendency for increased patient commitment was seen in patients who had received an endorsement from an attending physician.

Systematic review of the literature did not identify any well-evaluated methods specifically aimed at improving professional compliance to cardiac rehabilitation. One multifaceted approach suggested benefit, but the importance of the intervention relating to improvement in professional compliance could not be distinguished from other patient-directed aspects of the intervention. The resource and therefore cost implications of this intervention are also unclear.

All interventions identified were aimed at improving overall cardiac rehabilitation attendance. It was surprising that no evaluations of interventions targeted at service improvements for specific patient groups were reported. Frequently under-represented patient groups include women, the elderly, ethnic minorities and patients with more severe presentation of disease or co-morbidity.

Although few trials were found with the intention of improving cardiac rehabilitation uptake and adherence by improving professional compliance, several areas for intervention are suggested in the literature. Many may already be regular practice, but some may have application in the provision of services to under-represented groups.

Uptake of rehabilitation services is influenced by the knowledge and enthusiasm of the physician and providers in the referral process.[46,62,194] Consequently, education of physicians and providers on the benefits of cardiac rehabilitation may help to improve referral and uptake.[37,46] This may be accomplished best by the involvement of referring physicians in the programme.[185] A coherent approach to the education of programme coordinators and staff on the benefits of cardiac rehabilitation and its application in patient groups may lead to better understanding of patient eligibility and thus wider invitation.[193] Appointment of a programme director to lead, audit and commission appropriate resources for cardiac rehabilitation may lead to improvements in service management and provision.[32] This may facilitate the running of programmes in accordance with national guidelines, which may help to improve provision.[32]

Although none of the studies included in the systematic review was of adequate quality to suggest that the use of clinical pathways may be of value in the management of cardiac rehabilitation referral, this approach may merit further investigation. The use of clinical pathways with explicit criteria for patient eligibility may be an appropriate way to manage and streamline referral and invitation.[32,116,194]

Flexibility in timing of care and support may be important in improving uptake of services. Visits at home by healthcare professionals may serve to provide continuity of care and improve uptake of cardiac rehabilitation.[128] The provision of cardiac rehabilitation early after discharge may coincide with the time of patients' greatest need for support and greatest motivation, and early invitation and provision may be rewarded by increased uptake.[195] Some patients may not find a particular date for commencing rehabilitation suitable, and flexibility and removal of time restrictions may lead to an increase in uptake.[135]

The general scarcity of evaluated methods may reflect an under-appreciation of the value of trials in evaluating new interventions. Programme coordinators may recognise deficits and the need for improvements in services and implement changes without formal evaluation. For example, it may be assumed that incorporation of a prompt for referral in a discharge summary would be an effective way of ensuring referral. However, this does not necessarily mean that the crucial outcome of increased patient uptake and attendance at cardiac rehabilitation will be achieved. The systematic review of the literature suggests that well-designed studies are required to test interventions aimed at improving professional compliance with cardiac rehabilitation.

Conclusions

Little research has been conducted aimed at improving professional compliance with cardiac rehabilitation. The systematic review identified few studies that specifically looked at improving patient uptake and adherence by intervening at the level of healthcare professional activities.

The conduct of the healthcare professional is central in the recruitment of patients to cardiac rehabilitation and their contribution is dependent on education, compliance with guidelines and coordination of services. Changes within cardiac rehabilitation services aimed at improving patient uptake and adherence should be evaluated in well-designed studies and the results disseminated and reviewed; otherwise, ineffective and inappropriate methods may become routine clinical practice.

Chapter 11

Health service costs of cardiac rehabilitation in the UK

Objectives

- To estimate the health service costs associated with cardiac rehabilitation programmes in the UK.
- To estimate the national budget attributable to outpatient cardiac rehabilitation in the UK.
- To explore how coverage could be increased if different configurations of service were provided within the existing budget.
- To explore how coverage could be increased with additional funding.

Health service costs associated with cardiac rehabilitation

Methods

The costs associated with the provision of cardiac rehabilitation services from the health service perspective were estimated by considering the staff, overheads, building capital and equipment costs. The costs borne by patients such as travel costs or expenses for special clothing were not included, but it was recognised that these could have important implications if patients perceived them to be large enough to deter their attendance.

The BACR/BHF survey, described in Chapter 4, provided information on the typical number of hours per week by broad staff categories spent in outpatient (phase 3) cardiac rehabilitation programmes. The additional questionnaire provided information on the number of patients referred, joining and completing cardiac rehabilitation, the total number of sessions, and number and length of sessions per week.

Centres that responded to the short questionnaire and provided information on staff input (n = 186; 65% of all UK centres identified by BACR/BHF) were stratified by a criterion of multidisciplinarity of staff input. This was based on the assumption that a greater variety of staff input is a proxy for higher service quality. The following professional categories were considered to be relevant to an outpatient cardiac rehabilitation programme (hereafter referred to as 'key staff'):

- physician (GP, cardiologist, general physician)
- nurse
- physiotherapist/sport scientist
- occupational therapist
- psychologist
- dietitian
- pharmacist.

Three groups were defined according to the number of different types of key staff: group 1 having more than five different types of key staff, group 2 having three to five types of key staff, and group 3 having two or fewer. The total number of centres in each of these groups is shown in *Table 27*. Ten centres within each group were chosen at random to conduct a more detailed costing study.

Staff costs

All 30 centres in the random sample were contacted between April and June 2002 and provided more detailed information on the grades of staff working in 2000 (the year of the BACR/BHF survey). Staff costs were estimated by multiplying the average numbers of hours per week worked for each grade of staff by the hourly pay for that grade. Hourly pay rates were calculated by dividing the midpoint of the relevant pay scale by the numbers of hours of expected work per annum, excluding annual leave, bank holidays, and training/study and sickness days. All

TABLE 27 *Stratification of cardiac rehabilitation centres (n = 186) by number of different types of key staff*

Group	No. of different types of key staff	No of centres	%
1	>5	38	20.4
2	3–5	135	72.6
3	≤ 2	13	7.0

TABLE 28 *Average hours per week by staff category*

Staff grade	Group 1[a] (*n* = 10)	Group 2[b] (*n* = 10)	Group 3[c] (*n* = 10)
Nurse grade:			
B		0.95	
E		7.2	
F	11.38	12.75	3
G	21.40	16.15	9.25
H	13.05	5.75	0.4
Physiotherapist:			
Helper		2	
Basic	0.20		
Senior I	10.05	5.4	2.7
Senior II		1.4	1.2
Superintendent III	2.6		
Superintendent IV	0.6		
Sport scientist		1.9	
Exercise physiologist	3.8		0.4
Occupational therapist:			
Basic	0.8		
Senior	2.7	0.05	0.3
Head	0.6		
Dietitian	0.47	0.18	
Senior dietitian	0.58	0.46	
Pharmacist	0.46	0.35	
Physician	0.38	0.75	
Clinical psychologist	0.67	0.3	
Cardiac technician	0.7	2	0.5
Social worker	0.1		
Secretary	4.2	5.04	0.3
Total (SD)	74.7 (5.8)	62.6 (4.7)	18.0 (2.9)

[a] Centres with more than five key staff.
[b] Centres with three to five key staff.
[c] Centres with two or fewer key staff.

pay scales were those prevailing on 1 April 2001 and included employers' on-costs (employers' contribution to national insurance plus 4% of salary contribution to superannuation).[196] Salaries information was taken from www.nhscareers.nhs.uk.[197] A detailed summary of unit cost estimates for different staff categories and grades is shown in Appendix 16.

Non-staff-related costs

Non-staff-related costs refer to the overheads, building capital and equipment costs associated with running cardiac rehabilitation services. Most cardiac rehabilitation services tend to use a number of different facilities to deliver the different components of the programme and do not have these figures readily available. Hence, allowances for indirect overheads (the costs of the support services such as human resources, finance and estates required to carry out the services main functions) and building capital (the costs assigned to treatment and non-treatment space) relative to the midpoint of the relevant pay scale were based on Netten and colleagues[196] (see Appendix 16).

The required equipment was based on current recommendations from the BACR (see Appendix 17). The unit costs were obtained from the coordinator of the cardiac rehabilitation team of the Bristol Royal Infirmary. An equivalent annual cost was estimated by using an annuity factor of 6% and assumed lifespan of 5 years. Annual costs accounted for approximately £861 [value added tax (VAT) included].

Direct overheads, that is, the costs associated with lighting, heating and cleaning, were assumed to be 11% of the sum of staff costs, indirect overheads, building capital and equipment costs. This was based on previous studies carried out in hospital settings where the direct overheads were found to account for 4–18% (midpoint 11%) of total costs.[198–200]

TABLE 29 *Service provision, referral, uptake and completion rates for 30 UK cardiac rehabilitation centres in 2000 (stratified by staff mix)*

	Group 1 (*n* = 10)		Group 2 (*n* = 10)		Group 3 (*n* = 10)	
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**
Hours per patient	29.0	27	24	215	20	17.5
No. referred	282.4	289	352.5	255	170.7	150
No. joined	157.3	148	194.3	172	97.9	104
% of referrals	56	51	55	67	57	69
No. completed	126.3	104	158	150	89	92
% of referrals	45	36	45	59	52	62

TABLE 30 *Average cost estimates for cardiac rehabilitation (2000/01 prices)*

Costs (£)	**Group 1**		**Group 2**		**Group 3**		**Weighted costs**	
	Staff costs	**Total costs**	**Staff costs**	**Total costs**	**Staff costs**	**Total costs**	**Staff costs**	**Total costs**
Per year/centre	53,100	72,700	42,100	57,400	12,400	17,600	42,300	57,700
Per patient referred	243	330	137	186	127	249	157	220
Per patient joined	421	571	236	320	174	324	269	371
Per patient completed	542	738	317	429	186	344	354	486
Per hour	20	27	14	20	14	30	15	22

The total cost of cardiac rehabilitation was estimated for each centre, and the cost per patient referred, joined and completed estimated. The cost per hour was also estimated, taking the cost per patient completing the programmes as the denominator. The costs of each centre within a group were then averaged. A weighted average cost was also estimated, using the proportion of centres nationally falling within each group (see *Table 27*).

Results

Information on the weekly staff input by staff category and grade for each centre in the random sample is shown in *Table 28* (a detailed summary of staff resource data for each centre is given in Appendix 18). Group 1 had higher levels of weekly staff input (75 hours) than centres in groups 2 (62 hours) and 3 (18 hours).

The average duration of the programmes by group is shown in *Table 29*. Centres that employ more than five different key staff (group 1) provide the most intensive service per patient, with an average duration of 29 hours per patient. This compares to 24 hours per patient for group 2 centres and 20 hours for group 3 centres (details given in Appendix 19). *Table 29* also gives, by group, the absolute number of patients referred, joining and completing cardiac rehabilitation programmes. This varied widely, with the highest average numbers being in group 2.

The average staff costs and average total costs of cardiac rehabilitation are presented for each group in *Table 30* (more details shown in Appendix 20). There was a considerable difference in the cost of an average centre and in the average cost per patient between each group. The total average cost per patient completing the programme was £542 for group 1, £317 for group 2 and £186 for group 3. Staff costs accounted for 73% of the total costs for centres in groups 1 and 2, and 70% for centres in group 3 (based on cost per centre).

Figure 4 illustrates that nursing costs are the most important share of total staff costs, accounting for about 62% of total staff costs in group 1 centres, 67% in group 2 and 71% in group 3. Physiotherapy costs are the second most important share of total costs, accounting for about 23% in group 1 and group 3 centres, and for about 14% in group 2 centres.

Weighted average staff and total costs are shown in *Table 30*. The weighted average cost per patient completing a cardiac rehabilitation programme was £354 (staff costs only) and £486 (total costs).

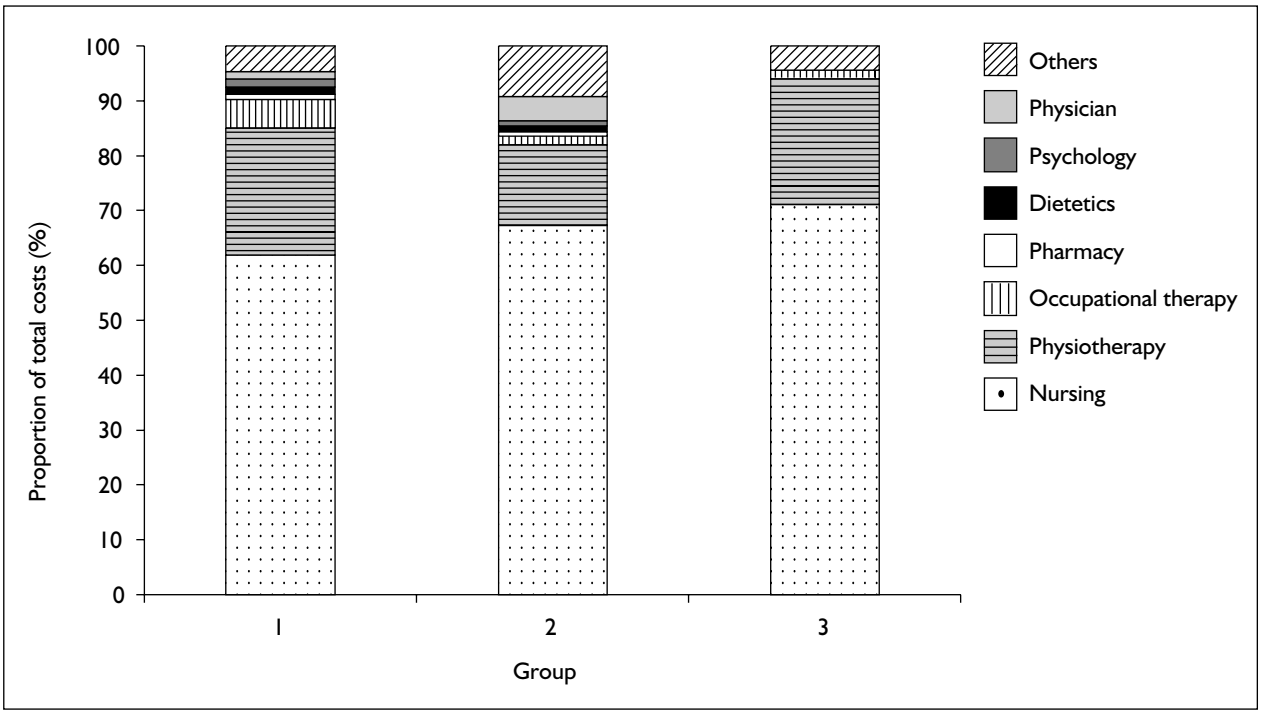

FIGURE 4 *Proportion of total staff costs attributable to staff categories*

The national budget attributable to cardiac rehabilitation

Methods

The budget attributable to outpatient (phase 3) cardiac rehabilitation was estimated separately for England, Wales, Scotland and Northern Ireland using data from the BACR/BHF survey and the additional questionnaire (as described in Chapter 4). The total number of patients completing a cardiac rehabilitation programme was estimated for each country. Where centres did not provide data, the IQR derived from responding centres for that country was used to calculate total numbers.

The budget for each country was estimated by multiplying the number of patients (reported as lower and upper bound) completing a cardiac rehabilitation programme by the weighted total average costs per patient completing cardiac rehabilitation (£486; see *Table 30*).

These estimated budget figures were then used to explore how coverage could be increased if a different configuration of cardiac rehabilitation services were provided. An estimate was made of the number of patients that could be treated if rehabilitation services were entirely provided in centres with three to five key staff (as in group 2, see above) or in a different scenario, in centres with two or fewer key staff (as in group 3). In addition, an estimate was made of the necessary budget increase to provide cardiac rehabilitation to all potentially eligible patients using data from the analysis presented in Chapter 3. This estimation was undertaken by assuming that, first, cardiac rehabilitation would be uniformly provided in group 2 centres and, second, cardiac rehabilitation would be uniformly provided in group 3 centres.

This study also explored how additional funding could increase coverage. If unit costs per patient fall as the number of patients completing the rehabilitation programme rises (i.e. centres experience economies of scale), additional funding will imply that the number of extra patients treated is higher than proportionate. A possible association between staffing costs per patient and the number of patients treated was, therefore, examined. First, the log-transformed costs and log-transformed numbers of patients were plotted, as both variables have a log-normal distribution. Secondly, a simple log-linear regression model was used to estimate the relationship between costs per patient, as the dependent variable, and the annual number of patients completing the rehabilitation programme, as the independent variable. An additional model was estimated, controlling for numbers of staff employed on cardiac rehabilitation. The regression coefficient for number of patients in these log-linear regression

TABLE 31 *Estimated budget attributable to cardiac rehabilitation by country (2000/01 prices)*

	England	Wales	Scotland	Northern Ireland
Estimated no. of patients completing outpatient cardiac rehabilitation[a]	25,700–39,000	2,100–3,500	2,500–4,700	1,000–1,400
Estimated budget attributable to outpatient cardiac rehabilitation	£12,513,000–18,975,000	£1,018,000–1,683,000	£1,222,000–2,276,000	£487,000–658,000

[a] Numbers were estimated by using information form the BACR/BHF survey for 2000. Data for non-responding centres were imputed by IQR for the relevant country.

TABLE 32 *Estimated impact of a change in service configuration given current budget*

	England	Wales	Scotland	Northern Ireland
Estimated no. of patients completing outpatient cardiac rehabilitation in 2000 (current service provision)	25,700–39,000	2,100–3,500	2,500–4,700	1,000–1,400
Estimated no. of patients able to be treated with a group 2 type service (i.e. three to five key staff) without expanding budget	26,100–44,200	2,400–3,900	2,800–5,300	1,100–1,500
Estimated no. of additional patients if all treated with a group 2 type service (based on the midpoint of the ranges reported above)	4,300	400	500	200
% increase in coverage	13	13	13	13
Estimated no. of patients able to be treated with a group 3 type service (i.e. two or fewer key staff) without expanding budget	36,400–55,100	3,000–4,900	3,600–6,600	1,400–1,900
Estimated no. of additional patients if all treated with a group 3 type service (based on the midpoint of the ranges reported above)	13,400	1,100	1,500	500
% increase in coverage	41	41	41	41

models measures the elasticity of the cost per patient with respect to the number of patients completing the programme, that is, the percentage change in costs for a given percentage change in number of patients.

Results

The estimated budgets attributable to cardiac rehabilitation by country are shown in *Table 31*. The current budget was estimated to be approximately £12.5–19.0 million in England, £1.2–2.3 million in Scotland, £1.0–1.7 million in Wales and £0.4–0.7 million in Northern Ireland. Overall, this would result in a budget estimate of £15.2–23.6 million for outpatient cardiac rehabilitation for the whole of the UK.

Table 32 shows the estimated impact of a change in service configuration for two different scenarios by country. It was estimated that approximately 5,300 more patients across the UK could be treated if the service were provided in cardiac rehabilitation centres with the staffing level of those in the 'group 2' sample. This corresponds to a 13% increase in coverage compared with the current situation. If services were provided with cardiac rehabilitation centres with low staffing levels (group 3), approximately 16,490 more patients could be treated, corresponding to a 41% increase in coverage compared with the current situation.

As shown in Chapter 3, around 266,800 patients were potentially eligible for cardiac rehabilitation in England in 2000. Assuming that group 2 services were uniformly provided, an annual budget of approximately £115 million would be required for the provision of cardiac rehabilitation to all patients. This represents a 630% increase in the estimated current budget attributable to cardiac rehabilitation.

TABLE 33 *Regression model for staff costs per patient completing cardiac rehabilitation (ln costs)*

	β	SE	95% CI	p
Constant	5.97	0.643	4.647 to 7.286	<0.0001
ln no. of patients	–0.10	0.143	–0.94 to 0.193	0.49
$R^2 = 0.02$, $n = 30$, $F = 0.49$, $p = 0.49$				

TABLE 34 *Regression model for staff costs per patient completing cardiac rehabilitation (ln costs), controlling for group*

	β	SE	95% CI	p
Constant	7.33	0.592	6.11 to 8.55	<0.0001
ln no. of patients	–0.245	0.117	–0.488 to –0.002	0.048
Group 1	–	–	–	–
Group 2	–0.733	0.335	–1.422 to –0.042	0.038
Group 3	–1.489	0.340	–2.190 to –0.788	<0.0001
$R^2 = 0.44$, $n = 30$, $F = 6.66$, $p < 0.002$				

Using a more limited criterion of need, namely, considering only patients with acute myocardial infarction, unstable angina, CAGB and PTCA as eligible, an annual budget of approximately £56 million would be required for the provision of cardiac rehabilitation, an increase of 260% in the current budget.

By extending the provision of cardiac rehabilitation using staffing configurations of group 3 services, an approximate annual budget of between £45 and £92 million would be required for treating all potentially eligible patients. This represents a 200–500% increase in the current annual budget attributable to cardiac rehabilitation.

Figure 5 shows the relationship between annual numbers of patients completing cardiac rehabilitation and the staff costs per patients. It suggests that the costs fall as the annual patient throughput increases. *Figure 6* shows the same relationship but stratified by group.

The simple regression showed no significant relationship between staff costs per patient and numbers of patients completing cardiac rehabilitation (*Table 33*).

Further exploration of the data, making allowance for the differing staffing patterns in groups 1–3, showed a clear relationship between costs and numbers completing cardiac rehabilitation within each group. The results of this model including group as an independent dummy variable are shown in *Table 34*. The equations for predicting the staff costs per patient completing cardiac rehabilitation are as follows:

Group 1: ln (cost per patient) =
7.33 – 0.245 ln (number of patients)
Group 2: ln (cost per patient) =
7.33 – 0.245 ln (number of patients) –0.733
Group 3: ln (cost per patient) =
7.33 – 0.245 ln (number of patients) –1.489

This suggests that cardiac rehabilitation centres experience economies of scale when different levels of multidisciplinarity of staff input, as in our defined groups, are taken into account. The cost per patient falls as the annual number of treated patients rises, although this was dependent on controlling for the multidisciplinarity of staff running the programme. Roughly, a 1% increase in the number of patients completing the programme leads to a 0.245% fall in the staff cost per patient completing the programme. This means that increasing patient throughput, by increased funding, may result in greater opportunity to increase coverage than might be expected.

Discussion

The results of this analysis suggest a weighted average staffing cost of £354 and a weighted total average cost of £486 per patient successfully completing a cardiac rehabilitation programme (2000/01 prices). Although previous studies have presented figures for the cost of cardiac

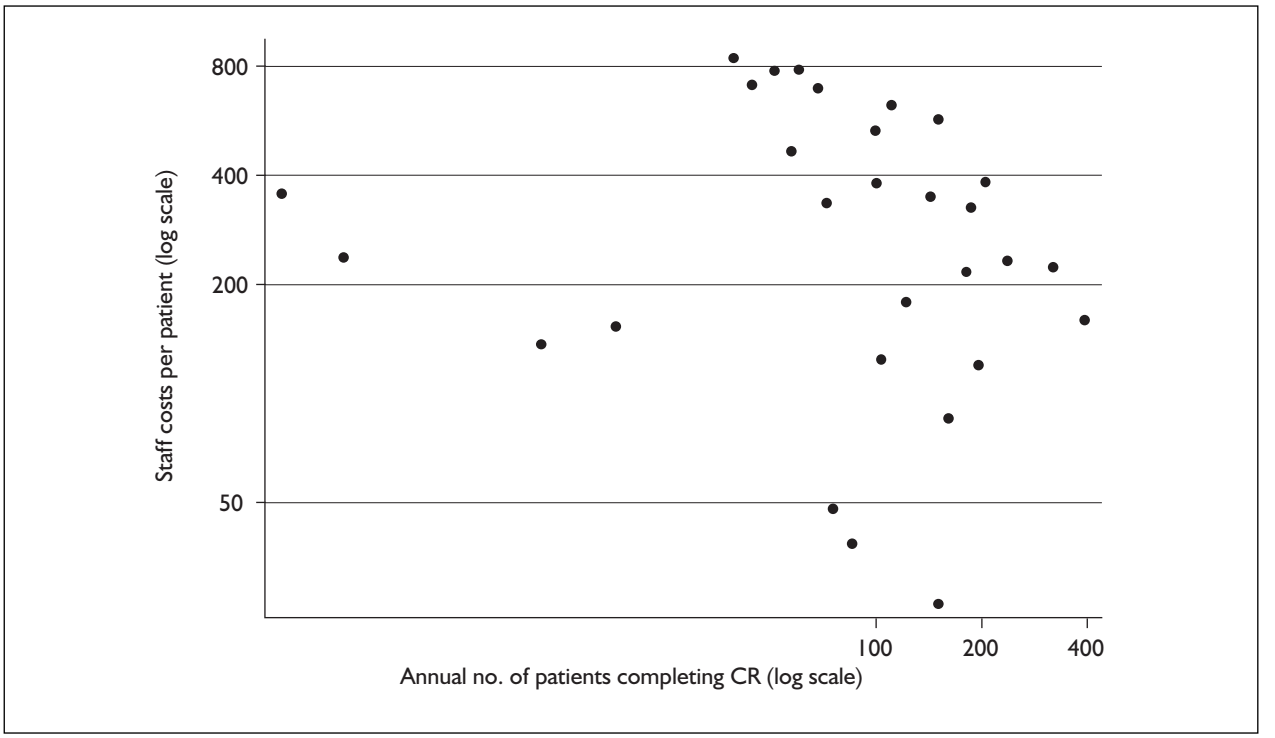

FIGURE 5 *Relationship between size (as measured by annual throughput of patients) and unit cost (staff costs) of cardiac rehabilitation programmes (all centres)*

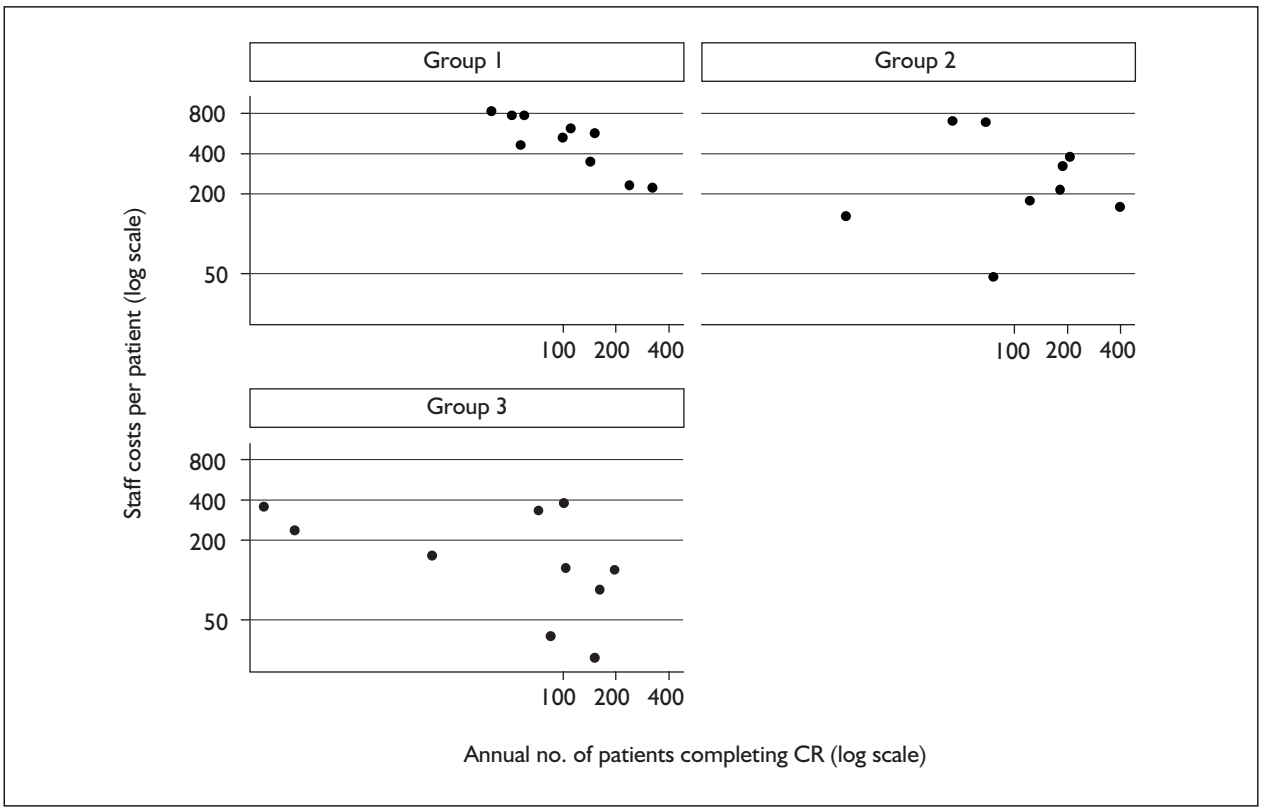

FIGURE 6 *Relationship between size (as measured by annual throughput of patients) and unit cost (staff costs) of cardiac rehabilitation programmes by group*

rehabilitation in the UK, they have been less comprehensive in their cost estimates. Nonetheless, the present findings are consistent with their findings, which suggested an average cost of cardiac rehabilitation per treated patient in the region of £200–£400.[25,79–82]

For example, Gray and colleagues[80] estimated a cost of £371 per patient completing a cardiac rehabilitation programme (median £223; 1994 prices). This was based on a sample of 16 cardiac rehabilitation centres in England and Wales, but their estimate excluded non-staff costs and contributions by non-specifically funded staff. Average staff costs of £350–425 (2001 prices) were estimated by the Scottish Intercollegiate Guidelines Network (SIGN) guideline development group, assuming 500 referred patients per year and a 90% uptake.[2] Based on the funding information given by 37 centres in the most recent BACR/BHF survey, Evans and co-workers[25] reported a cost of £50–712 (median £256) per patient completing cardiac rehabilitation.

By using information from the BACR/BHF survey and an additional questionnaire, all staff contributions could be measured and valued. The analysis shows that centres with higher levels of staff mix provide a more expensive service per patient treated than centres that employ fewer types of key staff. This is due to a longer duration of cardiac rehabilitation programmes offered by centres in group 1 (29 hours per patient) compared with the average duration of programmes offered by centres in group 2 (24 hours) and group 3 (20 hours), as well as the higher weekly staff input into programmes offered by centres with more types of key staff. This did not correspond with higher numbers of patients entering and completing the programmes. Thus, patients treated in centres with a higher level of multidisciplinarity received the most intense rehabilitation programme in terms of the duration of the programme and staff/patient ratio. Although the heterogeneity of cardiac rehabilitation services has long been acknowledged, evidence is lacking to suggest that programmes with a higher level of multidisciplinarity offer improved patient outcomes. Such services may not even represent higher service quality; for example, adherence was lower in the most multidisciplinary and intensive services.

This analysis has some limitations. Ideally, information on non-staff related costs such as direct overheads and capital costs should have been obtained from each rehabilitation centre in the sample. From a practical point of view, this was not feasible. The advantage of this study is the size of the sample, which allowed the cost differences due to different staff configurations to be explored in detail.

The costs of equipment were also included, based on current recommendations from the BACR. However, this list did not include equipment for undertaking ECG-exercise testing. Cardiac rehabilitation centres may carry out exercise testing before and after cardiac rehabilitation to assess patients and will, therefore, incur higher costs. Annual costs of equipment (treadmills, consumables for ECG, etc.) have been estimated to account for approximately £25,000 (Sally Turner, Alton Cardiac Rehabilitation Centre: personal communication, 2 December 2002).

Some extrapolations had to be made to calculate the total numbers of patients completing a programme, because not all centres replied to the survey and provided comprehensive activity data. This is possibly due to their lack of automated systems to extract these data, lack of audit facilities or being in the process of installing systems to collect audit data to satisfy the requirements of the NSF-CHD. However, the authors believe that their estimate of an annual budget attributable to cardiac rehabilitation of £15.2–23.6 million for the whole of the UK is a refined update of previous budget estimates, for example, £8–34 million by Taylor and Kirby[81] based on a converted US cost estimate.

The results of the simple budget analysis show that by providing a service as offered in group 3 centres, the overall service provision could be increased by approximately 40% with current funding. Providing cardiac rehabilitation as offered in group 2 centres, which represents the average cardiac service in the UK, could lead to an approximately 13% increase in coverage. This could be of importance given limited resources and the large extent of unmet need, as shown in Chapter 3.

The resource implications for extending cardiac rehabilitation to a greater proportion of eligible patients and to other groups of patients as recommended by the NSF-CHD are not clear. Only a minority of centres, as reported in Chapter 4, state that they have spare capacity. It is also not obvious whether the difference between the number of referred and enrolled patients represents spare capacity, as many centres have waiting lists that restrict the number of patients receiving treatment. Therefore, the extension of cardiac rehabilitation may require extra resources. The costs of these resources will be dependent on

local factors such as current provision of staff, the opportunity costs of extending the role of existing staff employed in other areas, existing (spare) capacity and facilities and, if not available, the costs of hiring facilities, for example in community sport centres.

This study confirms the finding that cardiac rehabilitation centres experience economies of scale, as first reported by Gray and colleagues.[80] However, this was only apparent when multidisciplinarity of staff input, as defined by the three groups, was explicitly taken into account. This finding suggests that any budget increase could lead to a more than proportionate improvement in coverage of cardiac rehabilitation services.

This analysis considers only the direct costs of cardiac rehabilitation. Future assessments of the cost-effectiveness of cardiac rehabilitation need to consider the future savings associated with reduced subsequent healthcare utilisation related to cardiac disease. The inclusion of future costs related to successfully rehabilitated patients living longer and requiring health services unrelated to cardiac disease is more controversial. Also to be considered are the future productivity gains associated, for example, with earlier return to work. The inclusion of costs incurred by patients such as expenses for travelling and special clothing will depend on the perspective from which the costs analysis is conducted. A full economic evaluation requires the comparison of the resource use changes with improved health consequences, that is, the effectiveness of cardiac rehabilitation.

Conclusions

The average costs of cardiac rehabilitation to the health service per patient successfully completing a cardiac rehabilitation programme are about £350 (staff costs only) and £490 (total costs) per patient. Outpatient cardiac rehabilitation represents an NHS cost of between £15.2 and 23.6 million in the UK. Cost variation across centres is partly explained by a higher dose of intervention in terms of duration and staff/patient ratio. There is a need to quantify the heterogeneity of services in terms of benefits. Trials comparing complex multidisciplinary rehabilitation with simpler regimens require evaluation of their costs and effectiveness.

If all services were modelled on the most common configuration of staffing (group 2), approximately 13% more patients could be treated with the same annual budget, but if the simpler group 3 services were to be uniformly provided, 40% more patients could be treated. The levels of need for cardiac rehabilitation, using the more modest criteria of need (see Chapter 3), suggest that, at best, fewer than 30–43% of eligible patients are referred and, of these, about half join cardiac rehabilitation programmes. This suggests that the capacity to increase provision by 40% within current budgets would meet between 42 and 60% of the population need for treatment.

Higher funding would be needed to increase provision to match need and to meet NSF-CHD targets. An approximate 260–630% increase in the annual current budget is required, to treat all potentially eligible patients depending on the staffing configurations of the cardiac rehabilitation programme. However, increased spending could lead to a more than proportionate increase in coverage. Further work is required to examine the best ways of using any increased funding, as it is likely that the potential of different services to increase capacity will vary markedly, and the associated costs will differ if, for example, new capital schemes are required.

Chapter 12
Conclusions

Outpatient cardiac rehabilitation should be available to patients with a range of cardiovascular diagnoses and after revascularisation procedures, but previous studies have shown that uptake is low, particularly in some specific patient groups. While many barriers to participation have been described, the effectiveness of interventions to improve uptake and adherence has not been assessed by systematic review. Furthermore, the cost implications of interventions to improve uptake and adherence and of increasing overall provision to meet total population need have not been estimated. Conclusions presented here are based around the objectives set in Chapter 2.

What is the population need for cardiac rehabilitation?

Population need for cardiac rehabilitation in the UK in 1999–2000 was assessed from hospital discharge statistics in England, Wales and Northern Ireland. The researchers were unable to use equivalent data for Scotland.

Two criteria for eligibility for cardiac rehabilitation were considered: patients with acute myocardial infarction, unstable angina or following a revascularisation procedure; and all patients discharged alive with a primary diagnosis of ischaemic heart disease or following revascularisation. The former, more conservative estimate of need, identified nearly 146,000 patients per year as eligible for cardiac rehabilitation in England, Wales and Northern Ireland. The latter gives a considerably larger estimate of 299,000 patients per year, but includes patients with chronic ischaemic heart disease, some of whom may be considered eligible for participation in some programmes and who may benefit from rehabilitation. Although these patients are not currently specified as immediate priorities for cardiac rehabilitation, for example in the NSF-CHD, many may be deserving of rehabilitation or appropriate lifestyle advice and modification as services develop.

Who is not receiving cardiac rehabilitation?

To estimate the level of cardiac rehabilitation provision, data from the 2000 BACR/BHF survey of cardiac rehabilitation centres were combined with hospital discharge statistics. The overall response rate of survey centres was 67% and IQRs were imputed for non-responders. This gave a range of estimates of numbers of patients referred to and joining a cardiac rehabilitation programme.

It was estimated that in England about 53% (range 45–67%), in Wales about 72% (range 59–81%) and in Northern Ireland about 30% (range 25–36%) of acute myocardial infarction, unstable angina and revascularisation patients were referred to cardiac rehabilitation in 2000. The proportions of patients joining a programme were about 33% (range 27–41%), 40% (range 38–46%) and 22% (range 18–25%), respectively. As this considers only the limited eligibility criteria as the denominator it reflects an overestimate if centres provided services to other patient groups. Applying the less inclusive eligibility criteria of any ischaemic heart disease or revascularisation, it was estimated that in England about 26%, in Wales about 32% and in Northern Ireland about 14% of patients were referred to cardiac rehabilitation in 2000. The corresponding figures for patients joining a programme were 16%, 18% and 11%, respectively. A survey of rehabilitation centres suggested that an average of about 63% of all patients referred joined a programme and that about 48% of referrals completed a course.

There appeared to be variation in service provision across the UK, with a higher proportion of eligible patients referred to and joining cardiac rehabilitation programmes in England and Wales than in Northern Ireland. Since the need for rehabilitation is substantially greater in Northern Ireland (and Scotland), this represents a considerable disparity between uptake and need.

The data demonstrate that many eligible patients who may derive benefit are not referred or invited,

do not respond to invitation, or do not adhere to cardiac rehabilitation. Some of the shortfall in referral and invitation may be explained by the clinical eligibility criteria used in selecting patients as appropriate for cardiac rehabilitation. This selection is mainly by health status before discharge. From the clinical exclusion data in an RCT with minimal exclusions, about 81% of patients were identified as eligible for rehabilitation after myocardial infarction and, although slightly lower than the 85% stated in the NSF-CHD, this is a reasonable overall estimate. The remaining 19% of patients were considered unsuitable for outpatient rehabilitation, mainly on the basis of co-morbidity or frailty. This is not to say that these patients may not gain materially from secondary prevention or individually selected components of cardiac rehabilitation. Indeed, many eligible and included patients may only be suited to, and gain benefit from, specific aspects of rehabilitation.

The definition of eligibility is important. In an RCT setting with minimal exclusions and appropriate documentation the eligibility criteria are clearly defined. In a non-trial setting the possibility arises that eligibility can be flexible and take on a role in rationing services. This may, in part, explain the extra tier of exclusion observed within the randomised trial context in that, after referral, coordinators tended to exclude older patients and those with more severe presentation of coronary heart disease from outpatient cardiac rehabilitation, possibly on the basis of an exercise test. Clearly, frail, elderly people and those with co-morbidity are capable of benefiting from rehabilitation, as shown by trials of geriatric assessment and rehabilitation units, and everyday practice within the NHS. The nature of rehabilitation for such patients may be less intensive than for other patients and may involve attendance at a day hospital. Some linkage between cardiac rehabilitation and health services for elderly people would be desirable to ensure that appropriate rehabilitation is available to all, regardless of age.

Under-represented groups

In the national survey and in the RCT, uptake of cardiac rehabilitation tended to be lower in older patients than in younger age groups. However, having attended one class there was no evidence to suggest that older patients were more likely to drop out of rehabilitation. Women were less likely to attend in both settings, but in the trial this was largely explained by the increased age of women at presentation. It is not possible to draw firm conclusions about the attendance of black or Asian groups as national database data were incomplete for coding of ethnicity, and in the survey of rehabilitation centres numbers referred to and attending cardiac rehabilitation tended to be low.

Accessibility of information

Gathering data on patient need, eligibility and rehabilitation activity was problematic. To simplify the process and make estimates more precise, national analysis of audit data would be preferable to ad hoc surveys. Unfortunately, audit was found to be underdeveloped in cardiac rehabilitation. The survey in England showed an uncoordinated approach to data collection and audit, with considerable variation in methods and content. With the standards set out in the NSF-CHD, reproducible and comparable methods should be in place, but little evidence was found to suggest that this was so. The use of modern medical records systems and gathering of data with a national and policy-driven standardised tool are desirable. This would allow assessment of all stages of the rehabilitation process, starting with the original coronary heart disease diagnosis or procedure, and would include information on possible causes of under-representation.

Some programme coordinators reported that direct referral systems from surgery and clinics were in place aimed at improving uptake of cardiac rehabilitation. The use of methods to promote direct referral suggests that audit can bridge the gap between inpatient care and outpatient cardiac rehabilitation.

What is the effectiveness of different methods of improving uptake and of differential targeting of cardiac rehabilitation?

Barriers to participation in outpatient cardiac rehabilitation

Interviews with patients randomised to attend rehabilitation in a trial confirmed commonly perceived reasons for non-attendance at cardiac rehabilitation. The main reasons for non-attendance or dropout were: lack of interest, illness, transport difficulties, scheduling and care of dependants. These responses suggest that some aspects of non-attendance are amenable to intervention by addressing issues of motivation, perceived relevance of cardiac rehabilitation to future well being, co-morbidities, the site and time of sessions, transport and arrangement of care for dependents.

Interventions used in cardiac rehabilitation centres

The survey of cardiac rehabilitation coordinators found a high level of awareness of the problem of low uptake. Sixty-six percent of services that responded indicated that they had implemented measures to improve attendance. Interventions appropriate to all patients included follow-up telephone calls, personalised invitation, home visits and free transport. More specific interventions for under-represented groups (women, the elderly, ethnic minorities, patients with heart failure or angina) included individualised classes, buddy systems and inclusion in the programme of a spouse or relative.

Many interventions were reported and some represent the application of common-sense methods. Nevertheless, studies to show the sustainable effectiveness of interventions are necessary if the long-term benefits of interventions are to be confirmed and the value of interventions disseminated more widely. The possibility exists that a common-sense intervention may have a negative effect on attendance. For example, patients collected last and returned home first may value free hospital transport as part of the overall rehabilitation package, whereas patients subjected to an extended journey and long transit times may find this an inconvenience that influences subsequent participation.

Although the RCT represents the gold standard in the evaluation of new interventions, this may be considered inappropriate by a cardiac rehabilitation professional attempting to provide services to all patients. As a possible alternative to RCTs, improvement in uptake attributable to an intervention may be identified by audit. However, reproducible audit procedures need to be in place first.

Systematic review of the literature

To identify studies of interventions with the aim of improving uptake and adherence to cardiac rehabilitation, three systematic reviews were carried out. The issue of improving uptake and adherence was split into three major questions: how can recruitment to cardiac rehabilitation be improved (uptake); how can patients' adherence to cardiac rehabilitation and maintenance of lifestyle changes be improved; and how can professionals be encouraged to comply with guidelines and good practice? These were designed to identify interventions to improve all aspects of referral and invitation, uptake and adherence to cardiac rehabilitation.

The comprehensive systematic review of literature covered a large range of databases and handsearches. Studies identified were published in journals, theses and conference abstracts. It was disappointing to find that nearly half of the studies reporting potentially valuable methods to promote cardiac rehabilitation were found only in the grey literature, with little opportunity for access by interested healthcare professionals. Sharing of information is essential if effective methods are to be implemented. Of the studies identified, a minority were RCTs.

Although some studies that looked at altering patient behaviour were identified, there was very little literature on interventions aimed at encouraging healthcare professional compliance with guidelines or good practice regarding invitation and support of patients' cardiac rehabilitation. As the conduct of the healthcare professional is central in the recruitment of patients to cardiac rehabilitation it seems logical to study interventions relating to professional education, compliance with guidelines and coordination of services. In one RCT a multifaceted approach to transfer of care from hospital to general practice was associated with increased cardiac rehabilitation uptake. However, the relative importance of one specific aspect of the intervention directly concerning professional compliance could not be evaluated.

The systematic literature review identified some interventions to help improve patient uptake of cardiac rehabilitation. Invitation letters, pamphlets, telephone calls and home visits may be used to convey a motivational message. Trained lay volunteers providing support to patients in the period before an outpatient programme may facilitate subsequent attendance at cardiac rehabilitation.

Following successful recruitment of patients to cardiac rehabilitation it is important that patients adhere to the programme and maintain any associated lifestyle changes. Methods based on improvements in self-efficacy and behavioural feedback showed promise in improving and sustaining risk factor management.

Possible interventions suggested in the literature, but which have not been evaluated in trials, were identified as areas for future research. These were based on observations in trials, reviews and patient interviews. Interventions relating to professional compliance include education of healthcare professionals on the benefits of cardiac

rehabilitation, appointment of a programme director, use of clinical pathways with explicit patient eligibility criteria, flexibility in programme start dates, flexibility in programme times, and home visiting to provide continuity of care. Suggested interventions to improve uptake include early support and planning postdischarge by healthcare professionals, adaptation of services for under-represented groups, use of community facilities, provision of services in a community setting, and for motivated patients with appropriately supervised delivery, home-based methodologies. Unevaluated interventions to improve adherence include further approaches based on self-efficacy, including demonstrations of behaviours by previous patients, which may be of particular value in promoting dietary change. Alternative forms of exercise or diet modification may help to improve adherence, and this may be especially useful for women, elderly people and minority ethnic groups. The use of different forms of rehabilitation such as home-based programmes may be acceptable in highly motivated patients with less severe coronary heart disease.

The identification of so many interventions in need of evaluation suggests that there is value in the study of factors determining attendance. Well-conducted qualitative studies in providers and particularly in patients may be useful in identifying the attitudes, beliefs and values associated with successful cardiac rehabilitation. Since this review was completed, a qualitative study of factors influencing enrolment in cardiac rehabilitation has been published.[201] This study suggested that physician recommendation, encouragement from family and friends, and access to transportation are important factors in promoting enrolment.

What is the potential budget impact of increasing uptake of cardiac rehabilitation using different uptake interventions?

Service duration and configuration

The effectiveness of different intensities and multidisciplinarity of cardiac rehabilitation is not known. Systematic reviews include a wide range of interventions both more and less intense than current UK recommendations, but to date no attempt has been made to stratify effectiveness by service model.

The BACR/BHF survey of cardiac rehabilitation across the UK showed wide variations in intensity, programme content and staffing. However, the mean levels of service provision suggest that an 8-week programme with 2 hours per week of exercise training, 1 hour per week of education and half an hour per week of psychological intervention is typical.

In the UK, three service configurations were identified, based on numbers of different types of key staff. A service involving three to five key staff is most commonly provided, with 73% of programmes reporting this configuration. Few programmes had lower staffing levels, but 20% of programmes had more than five key staff. Until evidence is available on the effectiveness of more intensive interventions it seems reasonable to base projections on the moderate service configuration with its multidisciplinary structure.

Costs of cardiac rehabilitation

The average costs of cardiac rehabilitation to the health service per patient successfully completing a programme were estimated at about £350 (staff costs only) and £490 (total costs) at 2000/01 prices. In the UK this equates to an NHS cost of between £15.2 and £23.6 million. This range represents the uncertainty in identifying the total number of patients receiving cardiac rehabilitation in the UK. The lower figure is the number of patients completing a programme in centres who responded to the BACR/BHF survey, and the higher figure is an extrapolation of identified service levels to all known UK programmes. As the BACR/BHF database is an established and well-respected resource, it is likely that the non-responding centres are more recent and smaller programmes. Consequently, an overall UK cost estimate greater than £15.2 million but less than £23.6 million is probable. Again, this highlights the importance of consistent national audit in guiding the provision of cardiac rehabilitation.

A minority of centres reported spare capacity and this would have only a small potential impact on overall provision. On the basis of unmet need identified in the survey and applying the conservative eligibility criteria of acute myocardial infarction, unstable angina and revascularisation, it was estimated that a budget increase of approximately 260% would be required, representing an overall annual budget of about £56 million at 2000/01 prices. Clearly, this would be considerably greater if more than five key staff were included in the programme and the eligibility criteria were extended to all patients with a discharge diagnosis of coronary heart disease or heart failure, or following

revascularisation. This may imply a budget increase of up to 630% and an annual budget of approximately £115 million.

Other costs may be involved in the extension of provision, depending on local factors such as current levels of staffing, the opportunity costs of extending the role of existing staff, existing spare capacity and facilities and, if not available, the costs of hiring facilities, for example in community sport centres. Conversely, economies of scale may serve to reduce the extra budget required.

Additional costs of increasing uptake and adherence

Order of magnitude costs of interventions to improve uptake and adherence with cardiac rehabilitation may be inferred and these suggest a wide range of implied costs. Motivational interventions could replace existing methods of invitation at minimal cost, and the incorporation of motivational elements into an established home-visiting schedule may have little further implication for resources. The use of lay volunteers in promoting uptake of cardiac rehabilitation is likely to be more costly, with extensive training requirements and travel costs. Similarly, the introduction of liaison nurse coordination of transfer of care would be costly if recruitment of new staff was required. However, it may serve to define the role of the established liaison nurse in supporting patients and other healthcare professionals and coordination of postdischarge care. Strategies aimed at improving self-management could be incorporated into outpatient cardiac rehabilitation sessions, and training of rehabilitation staff in lifestyle evaluation may serve to formalise assessment and procedures already in place in cardiac rehabilitation.

Chapter 13

Key findings

Implications for healthcare

- Provision of outpatient cardiac rehabilitation in the UK is well below the NSF-CHD goal of 85% of patients with acute myocardial infarction and revascularisation being offered outpatient cardiac rehabilitation.
- Information on referral to and uptake of cardiac rehabilitation is incomplete, with widely varying estimates of provision, particularly in under-represented groups. Little is known about the capacity of cardiac rehabilitation centres to increase provision.
- There is an uncoordinated approach to audit data collection.
- Reasons reported by patients for non-attendance are amenable to intervention, but few interventions have been formally evaluated.
- Many interventions aimed at improving patient uptake, adherence and professional compliance with guidelines and good practice have been proposed, but few have been formally evaluated.
- Motivational communications and trained lay volunteers may help to improve uptake of cardiac rehabilitation.
- Self-management techniques may help to promote and sustain lifestyle changes associated with cardiac rehabilitation.
- Qualitative studies in providers and patients may identify attitudes, beliefs and values associated with cardiac rehabilitation.
- Information on costs of interventions is frequently not reported.
- Experience of low-cost interventions and good practice exists within many cardiac rehabilitation centres.
- Increased provision of outpatient cardiac rehabilitation will require additional resources.

Recommendations for research and development

- Trials comparing the cost-effectiveness of comprehensive multidisciplinary rehabilitation with simpler outpatient programmes.
- Economic and patient preference studies of the effects of different methods of using increased funding for cardiac rehabilitation, and evaluations of the impact of any increased funding.
- Evaluation of a range of interventions and good practice (including self-management techniques, motivational communication and the use of trained lay volunteers) to promote attendance in all patients and under-represented groups.
- Development of standardised audit methods in the context of modern records systems, appropriate training for dedicated staff and dialogue between service contributors. Standardisation of criteria for patient eligibility, regular and comprehensive data collection to estimate the need for and provision of cardiac rehabilitation.
- Identification of further areas for intervention through qualitative studies.
- Extension of low-cost interventions and good practice in rehabilitation.
- Regular updated systematic review of literature relating to uptake and adherence to cardiac rehabilitation to include literature not readily available to providers and non-UK studies.

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Andrew Beswick (Research Associate) contributed to the systematic review, audit and RCT, and prepared the report. Karen Rees (Research Fellow) acted as project coordinator and contributed to the systematic review and survey of UK provision. Ingolf Griebsch (Research Associate) prepared health service costs and population need. Fiona Taylor (Public Health Specialist Trainee) contributed to the systematic review and audit survey. Margaret Burke (Trials Search Coordinator for the Cochrane Heart Group) carried out the literature searches. Robert West (Reader in Epidemiology) contributed to the systematic review and RCT attendance, design and planning. Jackie Victory (Cardiac Rehabilitation Sister) contributed to the audit survey and the UK survey of provision. Jacqueline Brown (MRC Senior Scientist) prepared health service costs. Rod Taylor (Senior Lecturer in Public Health and Epidemiology) worked on the UK survey of provision. Shah Ebrahim (Professor of Epidemiology and Ageing) worked on the systematic review and coordinated the project.

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Appendix 1

Need for cardiac rehabilitation in the UK

TABLE 35 *Need for cardiac rehabilitation in England*

Gender	Age group	Population (in 1000s)	Counts							Rates per 100,000						
			AMI	HF	UA	CABG	PTCA	CABGp	Others	AMI	HF	UA	CABG	PTCA	CABGp	Others
Female	35–44	3,368.4	271	15	442	46	113	23	1,232	8.0	0.4	13.1	1.4	3.4	0.7	36.6
	45–54	3,451.0	1,154	86	2,072	311	523	72	4,915	33.4	2.5	60.0	9.0	15.2	2.1	142.4
	55–64	2,398.5	2,585	261	4,005	886	1,165	233	9,803	107.8	10.9	167.0	36.9	48.6	9.7	408.7
	65–74	2,253.2	4,586	808	6,148	1,399	1,316	410	13,777	203.5	35.9	272.9	62.1	58.4	18.2	611.5
	75–84	1,601.2	4,767	1,232	5,892	488	435	172	11,105	297.7	76.9	368.0	30.5	27.2	10.7	693.5
	85+	737.5	1,973	732	1,983	12	18	2	4,455	267.5	99.3	268.9	1.6	2.4	0.3	604.1
Male	35–44	3,450.0	1,768	88	1,587	359	667	91	3,923	51.2	2.6	46.0	10.4	19.3	2.6	113.7
	45–54	3,446.3	5,543	470	4,977	1,951	2,531	420	14,122	160.8	13.6	144.4	56.6	73.4	12.2	409.8
	55–64	2,361.5	7,977	1,138	8,325	4,638	3,818	968	24,906	337.8	48.2	352.5	196.4	161.7	41.0	1,054.7
	65–74	1,949.9	8,568	1,752	9,422	4,773	2,625	1,083	24,755	439.4	89.9	483.2	244.8	134.6	55.5	1,269.6
	75–84	1,017.8	5,379	1,399	5,711	1,058	638	371	12,074	528.5	137.5	561.1	104.0	62.7	36.5	1,186.3
	85+	265.5	1,156	356	1,074	19	23	4	2,247	435.3	134.1	404.4	7.2	8.7	1.5	846.2
Both	35–44	6,818.4	2,040	103	2,031	405	780	114	5,157	29.9	1.5	29.8	5.9	11.4	1.7	75.6
	45–54	6,897.2	6,698	557	7,052	2,262	3,054	492	19,043	97.1	8.1	102.2	32.8	44.3	7.1	276.1
	55–64	4,760.0	10,570	1,399	12,336	5,524	4,983	1,201	34,731	222.1	29.4	259.2	116.1	104.7	25.2	729.6
	65–74	4,203.0	13,162	2,562	15,577	6,173	3,941	1,493	38,561	313.2	61.0	370.6	146.9	93.8	35.5	917.5
	75–84	2,619.0	10,156	2,634	11,607	1,546	1,073	543	23,195	387.8	100.6	443.2	59.0	41.0	20.7	885.6
	85+	1,003.1	3,134	1,089	3,064	31	41	6	6,713	312.4	108.6	305.5	3.1	4.1	0.6	669.3
Total		26,300.7	45,760	8,344	51,667	15,941	13,872	3,849	127,400	174.0	31.7	196.4	60.6	52.7	14.6	484.4

Source: HES, England. AMI, acute myocardial infarction; HF, heart failure; CABG, coronary artery bypass graft; PTCA, percutaneous transluminal coronary angioplasty; UA, unstable angina; CABGp, CABG with AMI or HF or PTCA or UA within one admission episode; All others: all patients who have been admitted more than once and with more than one discharge diagnosis.

TABLE 36 *Need for cardiac rehabilitation in Wales*

Gender	Age group	Population (in 1000s)	Counts							Rates per 100,000						
			AMI	HF	UA	CABG	PTCA	CABGp	Others	AMI	HF	UA	CABG	PTCA	CABGp	Others
Female	35–44	201.9	22	0	37	1	3	3	86	10.9	0.0	18.3	0.5	1.5	1.5	42.6
	45–54	197.8	66	9	114	12	21	5	310	33.4	4.6	57.6	6.1	10.6	2.5	156.7
	55–64	160.8	205	32	258	48	42	15	662	127.5	19.9	160.4	29.9	26.1	9.3	411.7
	65–74	144.2	374	61	351	67	38	25	998	259.4	42.3	243.4	46.5	26.4	17.3	692.1
	75–84	108.5	347	112	350	19	8	15	962	319.8	103.2	322.6	17.5	7.4	13.8	886.6
	85+	44.2	152	76	97	0	0	0	406	343.9	171.9	219.5	0.0	0.0	0.0	918.6
Male	35–44	203.2	99	6	61	15	17	7	208	48.7	3.0	30.0	7.4	8.4	3.4	102.4
	45–54	196.5	408	34	311	85	98	31	916	207.6	17.3	158.3	43.3	49.9	15.8	466.2
	55–64	156.6	610	74	507	205	146	72	1,657	389.5	47.3	323.8	130.9	93.2	46.0	1,058.1
	65–74	125.2	603	162	570	183	93	63	1,614	481.6	129.4	455.3	146.2	74.3	50.3	1,289.1
	75–84	69.3	420	121	329	48	14	22	938	606.1	174.6	474.7	69.3	20.2	31.7	1,353.5
	85+	15.9	91	22	65	0	1	0	211	572.3	138.4	408.8	0.0	6.3	0.0	1,327.0
Both	35–44	405.1	122	6	98	16	20	10	294	30.1	1.5	24.2	3.9	4.9	2.5	72.6
	45–54	394.2	476	43	426	97	119	36	1,226	120.8	10.9	108.1	24.6	30.2	9.1	311.0
	55–64	317.4	816	106	765	253	188	87	2,320	257.1	33.4	241.0	79.7	59.2	27.4	730.9
	65–74	269.4	978	223	922	250	131	88	2,612	363.0	82.8	342.2	92.8	48.6	32.7	969.6
	75–84	177.9	768	233	680	67	22	37	1,903	431.7	131.0	382.2	37.7	12.4	20.8	1,069.7
	85+	60.1	243	98	162	0	1	0	618	404.3	163.1	269.6	0.0	1.7	0.0	1,028.3
Total		1,624.1	3,403	709	3,053	683	481	258	8,973	209.5	43.7	188.0	42.1	29.6	15.9	552.5

Source: PEDW.

TABLE 37 *Need for cardiac rehabilitation in Northern Ireland*

Gender	Age group	Population (in 1000s)	Counts							Rates per 100,000						
			AMI	HF	UA	CABG	PTCA	CABGp	Others	AMI	HF	UA	CABG	PTCA	CABGp	Others
Female	35–44	120.1	26	3	19	2	7	0	85	21.6	2.5	15.8	1.7	5.8	0.0	70.8
	45–54	98.7	82	11	102	11	47	0	258	83.1	11.1	103.3	11.1	47.6	0.0	261.4
	55–64	80.3	181	36	189	31	95	0	550	225.4	44.8	235.4	38.6	118.3	0.0	684.9
	65–74	67.6	271	105	276	38	79	0	693	400.9	155.3	408.3	56.2	116.9	0.0	1,025.1
	75–84	46.3	277	144	236	5	24	0	477	598.3	311.0	509.7	10.8	51.8	0.0	1,030.2
	85+	17.5	94	54	55	0	0	0	101	537.1	308.6	314.3	0.0	0.0	0.0	577.1
Male	35–44	115.9	108	6	74	16	63	0	252	93.2	5.2	63.8	13.8	54.4	0.0	217.4
	45–54	96.7	331	35	270	74	247	1	819	342.3	36.2	279.2	76.5	255.4	1.0	846.9
	55–64	75.6	468	117	514	183	358	3	1,401	619.0	154.8	679.9	242.1	473.5	4.0	1,853.2
	65–74	54.1	478	171	494	126	227	1	1,214	883.5	316.1	913.1	232.9	419.6	1.8	2,244.0
	75–84	28.4	249	138	215	25	31	0	436	876.8	485.9	757.0	88.0	109.2	0.0	1,535.2
	85+	6.1	40	43	37	0	0	0	59	655.7	704.9	606.6	0.0	0.0	0.0	967.2
Both	35–44	236	134	9	93	18	70	0	337	56.8	3.8	39.4	7.6	29.7	0.0	142.8
	45–54	195.3	413	46	372	85	294	1	1,077	211.5	23.6	190.5	43.5	150.5	0.5	551.5
	55–64	155.9	649	153	703	214	453	3	1,951	416.3	98.1	450.9	137.3	290.6	1.9	1,251.4
	65–74	121.7	749	276	770	164	306	1	1,907	615.4	226.8	632.7	134.8	251.4	0.8	1,567.0
	75–84	74.8	526	282	451	30	55	0	913	703.2	377.0	602.9	40.1	73.5	0.0	1,220.6
	85+	23.6	134	97	92	0	0	0	160	567.8	411.0	389.8	0.0	0.0	0.0	678.0
Total		807.3	2,605	863	2,481	511	1,178	5	6,345	322.7	106.9	307.3	63.3	145.9	0.6	786.0

Source: HIS, Northern Ireland.

Appendix 2

Need for and estimated level of cardiac rehabilitation provision in the UK

TABLE 38 *Need and estimated level of provision in England (total number of cardiac rehabilitation centres* n = *220)*

	Mean	SD	Median	IQR	*n*	Sum of all patients	Non-responding centres (*n*)	Total sum of patients (responding plus non-responding centres)		
								Mean	Median	IQR
No. of patients referred to CR	349.0	244.33	279.0	180–450	117	40,840	103	76,793	69,577	59,380–87,190
No. of patients joining CR	208.6	141.8	177.5	112–277	114	23,781	106	45,893	42,596	35,653–53,143

Eligible patients (source: HES)	No. of patients	Proportion of patients referred to CR (%) Data for non-responders imputed			Proportion of patients joining CR (%) Data for non-responders imputed		
		Mean	Median	IQR	Mean	Median	IQR
All patients with primary diagnosis of IHD	266,833	29	26	22–33	17	16	13–20
All patients discharged with AMI, CABG, PTCA, UA	131,089	59	53	45–67	35	33	27–41
All patients with primary diagnosis of IHD <75 years	202,001	38	34	29–43	23	21	18–26

IHD, ischaemic heart disease.

TABLE 39 *Need and estimated level of provision in Wales (total number of cardiac rehabilitation centres* n = *18)*

	Mean	SD	Median	IQR	*n*	Sum of all patients	Non-responding centres (*n*)	Total sum of patients (responding plus non-responding centres)		
								Mean	Median	IQR
No. of patients referred to CR	316.7	170.7	311	180–400	10	3,167	8	5,701	5,655	4,607–6,367
No. of patients joining CR	185.4	93.0	150	119–248	13	2,410	5	3,337	3,160	3,005–3,650

Eligible patients (source: PEDW)	No. of patients	Proportion of patients referred to CR (%) Data for non-responders imputed			Proportion of patients joining CR (%) Data for non-responders imputed		
		Mean	Median	IQR	Mean	Median	IQR
All patients with primary diagnosis of IHD	17,650	33	32	26–36	19	18	17–21
All patients discharged with AMI, CABG, PTCA, UA	7,878	72	72	59–81	42	40	38–46
All patients with primary diagnosis of IHD <75 years	12,728	45	44	36–50	26	25	24–29

TABLE 40 *Need and estimated level of provision in Northern Ireland (total number of cardiac rehabilitation centres* n = *10)*

	Mean	SD	Median	IQR	*n*	Sum of all patients	Non-responding centres (*n*)	Total sum of patients (responding plus non-responding centres)		
								Mean	Median	IQR
No. of patients referred to CR	205.5	101.9	196	141.5–269.5	4	822	6	2,055	1,998	1,671–2,439
No. of patients joining CR	146.5	60.4	154	107–186	4	586	6	1,465	1,510	1,228–1,702

Eligible patients (source: HIS)	No. of patients	Proportion of patients referred to CR (%) Data for non-responders imputed			Proportion of patients joining CR (%) Data for non-responders imputed		
		Mean	Median	IQR	Mean	Median	IQR
All patients with primary diagnosis of IHD	13,988	15	14	12–17	11	11	9–12
All patients discharged with AMI, CABG, PTCA, UA	6,780	30	30	25–36	22	22	18–25
All patients with primary diagnosis of IHD <75 years	11,248	18	18	15–22	13	13	11–15

TABLE 41 *Estimated level of provision in Scotland (total number of cardiac rehabilitation centres* n = *36)*

	Mean	SD	Median	IQR	*n*	Sum of all patients	Non-responding centres (*n*)	Total sum of patients (responding plus non-responding centres)		
								Mean	Median	IQR
No. of patients referred to CR	207.3	150.4	198.5	65–340	24	4,975	12	7,462	7,357	5,755–9,055
No. of patients joining CR	132.2	101.3	100	47–218	21	2,777	15	4,761	4,277	3,482–6,047

Appendix 3

British Association for Cardiac Rehabilitation additional postal questionnaire

Dear Cardiac Rehab Coordinator,

We have recently been funded by the NHS Health Technology Assessment Research & Development programme to look at the provision, uptake and adherence to cardiac rehabilitation programmes in currently under-represented groups, which includes women, elderly people, Black and Asian groups, and patients with diagnoses of angina, heart failure and post-revascularisation. As part of this work, we need an up-to-date picture of current service provision. We are aware that you have recently completed a questionnaire for the BHF/BACR survey, and we are collaborating with Dr Bethell and Sally Turner to use the data you have kindly provided. There are a few additional questions we need to ask that were not covered in the recent survey. We know you are extremely busy people so we have put together a short questionnaire that complements the BHF/BACR survey, that should only take a few minutes to complete. Any data will be added to the main BHF/BACR database. To be consistent, we are asking for information relevant to the period *1st January to 31st December 2000*. Please contact us if you have any queries regarding this. Please could you return the completed questionnaire in the SAE or fax through to FAO K Rees.

Thank you so much for your help with this important work

Very best wishes

Dr Karen Rees, BHF Research Fellow

ID ☐

ADDITIONAL SHORT QUESTIONNAIRE TO COMPLEMENT THE BHF/BACR DATABASE OF UK CARDIAC REHABILITATION CENTRES 2001

1. How long is your supervised phase 3 programme for each patient? (please give an average figure for each component of CCR, relevant to your programme)

Exercise component

No. weeks	No. sessions/week	Average length of sessions	Average no. patients/session
☐	☐	☐	☐

Health education component (e.g. Healthy diet, smoking cessation)

No. weeks	No. sessions/week	Average length of sessions	Average no. patients/session
☐	☐	☐	☐

Psychological component (e.g. Relaxation/stress management) if given

No. weeks	No. sessions/week	Average length of sessions	Average no. patients/session
☐	☐	☐	☐

Total for whole programme – if unable to break down into component sessions

No. weeks	No. sessions/week	Average length of sessions	Average no. patients/session
☐	☐	☐	☐

2. Do you make any special efforts to promote attendance at rehab sessions for any of the following groups? **(TICK ANY THAT APPLY)**

Women	☐	Patients with heart failure	☐
People aged 65+	☐	Patients with angina	☐
Black and Asian groups	☐	Patients who have had CABG/PTCA	☐

Please provide details of the methods you use:

---

3. Do you have any spare capacity within your current service for **additional patients?** ☐ Yes ☐ No

If yes, please indicate the number of additional patients that could be included without any increase in resources: ☐ patients/week

4. During the last year approximately how many patients were referred?

Total	Male	Female	65+ years	post-MI	CABG/PTCA
☐	☐	☐	☐	☐	☐

Heart Failure	Angina	Black and Asian groups
☐	☐	☐

During the year how many patients joined the programme?

Total	Male	Female	65+ years	post-MI	CABG/PTCA
☐	☐	☐	☐	☐	☐

Heart Failure	Angina	Black and Asian groups
☐	☐	☐

Of these patients, how many (eventually) completed the programme?

Total	Male	Female	65+ years	post-MI	CABG/PTCA
☐	☐	☐	☐	☐	☐

Heart Failure	Angina	Black and Asian groups
☐	☐	☐

With many thanks for your help in completing this questionnaire. Please could you post back in the envelope provided, or fax through (FAO K Rees) by 31st October 2001

CR Coordinator/contact.....

CR Programme, where based.....

Region.....

Appendix 4

Literature search strategies

Search terms for major databases are given. These terms were adapted appropriately for other databases.

Search strategy for MEDLINE

1 exp Heart diseases/
2 coronary.tw.
3 cardiac.tw.
4 CABG.tw.
5 myocardial.tw.
6 angina.tw.
7 heart failure.tw.
8 heart disease$.tw.
9 or/1-8
10 exp Rehabilitation/
11 exp Rehabilitation centers/
12 exp Rehabilitation nursing/
13 rehabil$.tw.
14 Aftercare/
15 aftercare.tw.
16 Convalescence/
17 convalescen$.tw.
18 recuperat$.tw.
19 or/10-18
20 9 and 19
21 exp Heart diseases/rh [Rehabilitation]
22 20 or 21
23 Patient education/
24 exp Counseling/
25 exp Exercise therapy/
26 Exercise/
27 exp Psychotherapy/
28 (patient adj2 educat$).tw.
29 counsel$.tw.
30 (behavi$ adj2 therap$).tw.
31 psychosocial$.tw.
32 ((lifestyle or life-style) adj2 intervent$).tw.
33 ((exercise$ or fitness) adj5 (treatment or intervent$ or program$)).tw.
34 ((lifestyle or life-style) adj5 (intervent$ or program$ or treatment$)).tw.
35 Nurse practitioners/
36 "nurse practitioner$".tw.
37 or/23-36
38 9 and 37
39 (secondary adj5 prevent$).tw.
40 Survival rate/
41 (reduc$ adj5 (morbid$ or mortal$)).tw.
42 Patient readmission/
43 rehospitali$.tw.
44 ((improv$ or increase$ or decrease$) adj5 (recover$ or function)).tw.
45 Disease management/
46 (disease adj2 manage$).tw.
47 Recovery of function/
48 exp "Costs and cost analysis"/
49 compliance.tw.
50 adheren$.tw.
51 non-compliance.tw.
52 costs.tw.
53 Patient compliance/
54 or/39-53
55 37 and 54 and 9
56 22 or 55

Search strategy for EMBASE

1 exp Heart disease/
2 coronary.tw.
3 cardiac.tw.
4 CABG.tw.
5 myocardial.tw.
6 angina.tw.
7 heart failure.tw.
8 heart disease$.tw.
9 or/1-8
10 exp rehabilitation/
11 exp rehabilitation center/
12 rehabil$.tw.
13 exp convalescence/
14 convalescen$.tw.
15 recuperat$.tw.
16 or/10-15
17 9 and 16
18 exp Heart disease/rh
19 Heart rehabilitation/
20 or/17-19
21 exp patient education/
22 exp counseling/
23 exp kinesiotherapy/
24 exp exercise/
25 exp psychotherapy/
26 (patient adj2 educat$).tw.
27 counsel$.tw.
28 (behavi$ adj2 therap$).tw.
29 psychosocial$.tw.
30 ((lifestyle or life-style) adj5 (intervent$ or

program$ or treatment$)).tw.
31 ((exercise$ or fitness$) adj5 (treatment$ or intervent$ or program$)).tw.
32 Nurse practitioner/
33 "nurse practitioner$".tw
34 or/21-33
35 9 and 34
36 exp survival/
37 (patient$ adj2 readmi$).tw.
38 rehospitali$.tw.
39 ((secondary or tertiary) adj5 prevent$).tw.
40 (reduc$ adj5 (mortal$ or morbid$)).tw.
41 ((improv$ or increase$ or decrease$) adj5 (recover$ or function$)).tw.
42 (disease$ adj2 manag$).tw.
43 exp aftercare/
44 aftercare.tw.
45 exp economic evaluation/
56 costs.tw.
57 Patient compliance/
58 (compliance or non-compliance).tw.
59 adheren$.tw.
50 Patient satisfaction/
51 or/36-50
52 35 and 51
45 20 or 52

The results of all searching were downloaded into a reference management database and then searched across all fields for the following terms:

Adherence
Dropout*
Drop-out*
Comply
Compliance
Noncompliance
Participant*
Participation
Referral*
Nonattend*
Attend*
Refusal*
Patient attitude*
Patient satisfaction*
Barrier*
Nonparticipant*
Non-participant*
Treatment refusal
Motivat*
Cost
Costs
Econom*

Appendix 5

Inclusion/exclusion form

Uptake and adherence to cardiac rehabilitation

First author
Source and date

Database number		
Date assessed		
	Excluded?	Included?
Uptake	A	A
Prof compliance	B	B
Adherence	C	C
Audits/descriptive	I	I
Economic	E	E

	Intervention to increase uptake by patients	Intervention to improve professional compliance	Intervention to improve adherence
Reviewer (initials)			
1. Is an intervention evaluated?			
2. Patients: AMI, CABG, PTCA, Angina, Heart Failure, Other CVD (Specify)			
3. Outcome: people attending, losses to follow up, adherence (medical advice, therapy, clinical events, rehospitalisation, costs)			

If 1, 2 and 3 yes then include study

4. Reason for exclusion	

Other information

5. Audit/descriptive information
6. Economic information

Appendix 6

Data extraction form

Data extraction form – HTA SR of uptake, patient adherence and professional compliance

Reference:

Database ID: **Date:**

Reviewer: (initials)

Subject relevant to: (circle all that apply)

A – Intervention to increase uptake by patients

B – Intervention to improve professional compliance

C – Intervention to improve patient adherence

1. Data Source: (circle) Published only Unpublished only mixed

Country of publication/recruitment –

2. Study type: (circle)

Between group comparisons:	RCT (adequate allocation concealment)
	Quasi RCT (inadequate allocation concealment, e.g. alternate allocation, by hospital No., DoB etc.)
	Non-randomised trial (e.g. Allocation to groups but no attempt at randomisation)
	Before and after study (comparing outcomes in different groups of patients before and after an intervention)
Within group comparisons:	Before and after study (comparing outcomes in the same patients before and after an intervention)

3. Quality of studies:

Creation of comparison groups

a) generation of random sequence method_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

b) concealment of allocation method_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

c) how allocation occurred (e.g. patient or doctor preference) detail _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

d) balance groups by design (e.g. matching) detail _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

e) within group comparisons (circle if applies)

Comparability of groups

a) Were comparison groups similar at baseline?	Yes	No	Unclear
b) Were prognostic factors identified?	Yes	No	Unclear
c) Was case-mix adjustment used to account for differences between groups?	Yes	No	Unclear
d) (For within group comparisons only) — were only paired responses analysed?	Yes	No	Unclear

Blinding of outcomes

a) Were outcomes assessed blind/independently of intervention? Yes No Unclear

Follow-up

a) Was there equal follow-up between groups? Yes No Unclear

b) What was the overall loss to follow-up? _____ Not reported

Sample

a) Prospective or retrospective sampling? Prospective Retrospective

b) Were inclusion and exclusion criteria specified? Yes No Unclear

c) Was the sample size planned (e.g. sample size calculation included)? Yes No Unclear

d) Is representativeness of the sample assessed? (add comments) Yes No Unclear

_____

4. <u>Participants studied:</u> (circle all that apply)

Diagnosis

Post MI CABG/PTCA Heart Failure (chronic / secondary to MI) Angina

Participants

Men Women Age limited (specify) Ethnic Minority Groups

For the whole sample:

Mean age (range) _____

Percentage men _____

Case mix (specify, e.g. 100% MI or mixed diagnoses and proportions) _____

Percentage white (if known) _____

Inclusion/Exclusion criteria (if stated) _____

_____

5. <u>Intervention</u> (investigator's description in as much detail as possible, including theoretical basis, intensity and duration, group or individual, setting, etc.)

A – Intervention to increase uptake by patients

_____

B – Intervention to improve professional compliance

_____

C – Intervention to improve patient adherence

_____

Description of comparison group (treatment or usual care) ____________________________

____

Duration of follow-up (not duration of intervention) __________________________

6. Outcomes: (circle all that apply)

Specified primary outcome (specify) __________________________

Attendance rates (give criteria used)

Adherence to rehabilitation/medical advice/therapy (give criteria used)

Clinical events

Rehospitalisation

Costs

Changes in risk factors

Other (specify)

Number of follow-up measurement points (give time intervals, e.g. 6 months, 1 year)

____

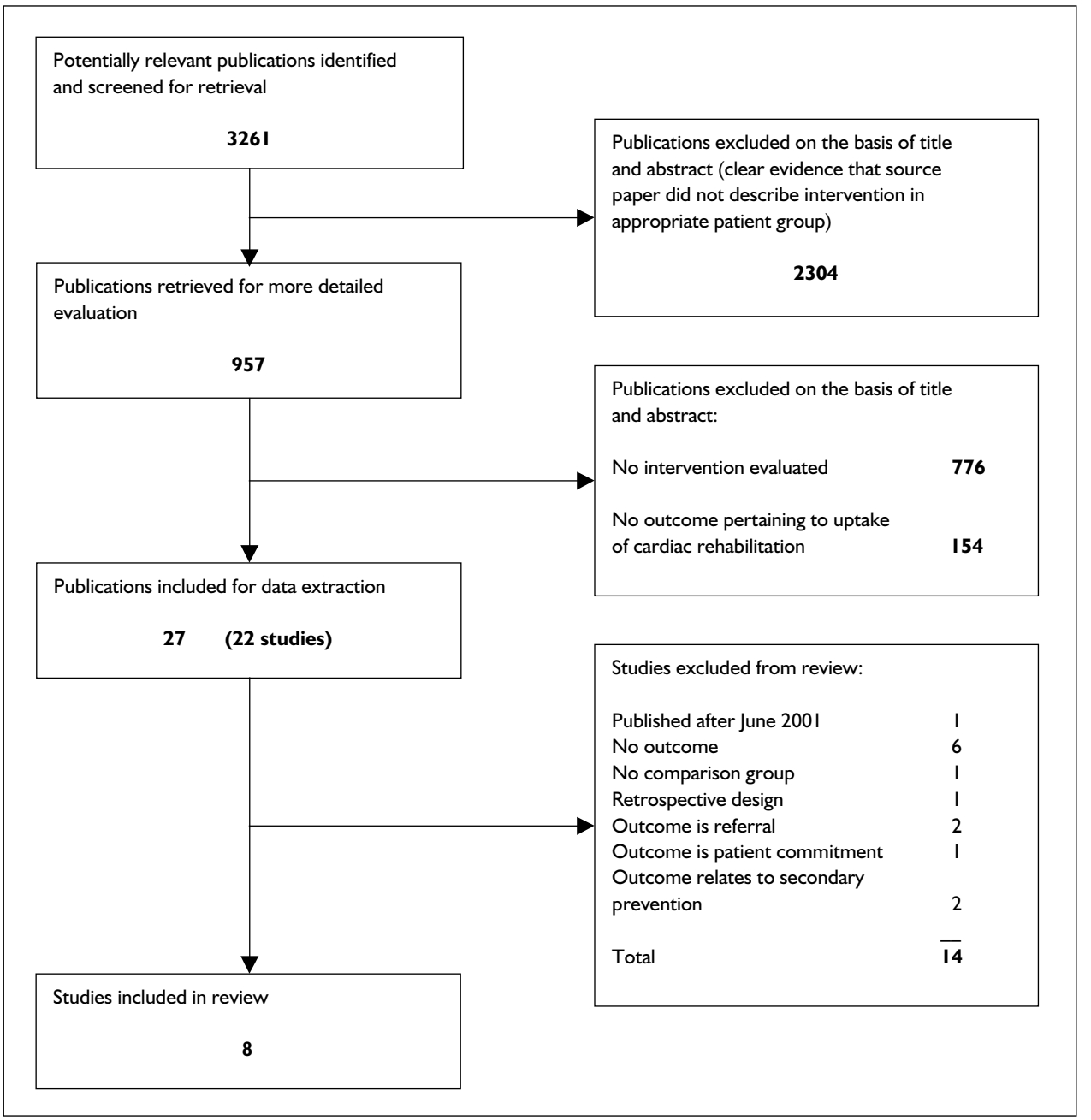
7. Study comparisons: (if multiple time points, use longest duration of follow-up)

Characteristics	Intervention/ Before	Control/ After	(additional column for 3 arm trial or 3 time phase studies)
Baseline characteristics: Number randomised Age (mean SD range) Sex (% male)			
Outcomes: Attendance Nos (%) Adherence to medication/therapy – Nos adhering (%) Adherence to medication/therapy – Nos adhering (%) Losses to follow-up Nos (%)			
Specified primary outcome: N(%) Clinical events: N(%) Total Mortality N(%) Cardiac Mortality N(%) Non-fatal MI N(%) Revascularisation N(%) CVD event (stroke/TIA) N(%) Other N(%)			
Hospitalisation/Rehospitalisation Number (%) of patients Number of occasions			
Costs (specify what)			
Other outcomes:			

8. Notes (what did the investigators find? Interesting features?)

Appendix 7

Flow diagram of the systematic review of interventions to improve uptake of cardiac rehabilitation (QUOROM statement flow diagram)



Appendix 8

Studies evaluating interventions to improve the uptake of cardiac rehabilitation

Studies are listed in terms of study design and the hierarchy of evidence, with RCTs first.

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Wyer *et al.*, 2001[105,106] UK (journal and thesis)	Parallel group RCT, 87 patients randomised	Patients were handed a sealed numbered envelope with a nominal letter. Half of the envelopes also contained an intervention letter. Envelope contents known to a research assistant only and had been allocated to intervention or control by random number assignment. Envelopes given to patients in numerical order. CR nurse not aware of group assigned to; however, no procedure in place to stop patients telling nurse which letter received. Comparison groups similar at baseline	All patients post-MI. Mean age 63 years, 87% men	Letters based on the theory of planned behaviour (Ajzen and Madden, 1986[107]) designed to increase attendance at outpatient CR were given to patients 3 days post-MI and sent 3 weeks post-MI. The first letter was designed to influence acceptance and the second was designed to influence attendance. Patients also received a nominal letter of thanks at 3 days and the standard letter detailing course dates as sent to control patients. After allocation to groups the CR nurse saw all patients for routine assessment and personal invitation to the programme. For patients who declined the offer of a place a brief second letter was sent wishing them well and informing them that they were still welcome to contact the team	Nominal letter of thanks given to patients at 3 days post-MI and the standard letter detailing course dates	Uptake defined as attendance at the outpatient CR programme. Uptake was 86% in the intervention group and 57% (authors state 59%) in the control group ($\chi^2 = 7.91$, df = 1, $p < 0.0025$)	Women were less likely to attend the programme, but neither age nor distance lived from the programme predicted attendance	A significant improvement in uptake of outpatient CR was observed in the group that received the letters designed to influence acceptance and attendance. The authors note that the intervention may have worked by acting as a fear message (wording in letter: "research has shown that attendance can reduce the chances of dying from another heart attack"), rather than through implementation of theory of planned behaviour

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Hillebrand *et al.*, 1995[108] Germany (journal) Relates to attendance at outpatient heart group after inpatient CR	Parallel group RCT, 94 patients randomised. Results reported for 87 (4 patients died, three refused follow-up)	Method of randomisation and allocation concealment unclear. Comparison groups were similar at baseline	Post-MI patients attending inpatient CR programme. Mean age 52 (33–60) years, 89% men	Special outpatient care programme to support blue-collar workers after MI to join coronary groups. The programme consisted of four different conversations between patients and a social worker: at end of rehabilitation programme, telephone contact after 4 weeks, home visit after 3 months and telephone contact after 6 months	No outpatient care programme	Attendance at cardiac group after 12 months. In the group with special outpatient care 57% of patients attended a cardiac group compared with 27% of controls ($p < 0.005$)		The authors note the motivating effect of an outpatient care programme as a link between inpatient CR and cardiac groups

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Jolly *et al.*, 1999[104] UK (journal) Also Bradley *et al.*, 1997[102] and Jolly *et al.*, 1998[103]	67 general practices randomised within strata (by fund-holding status, distance from local CR programme and number of whole-time partner equivalents). 277 patients from randomised intervention practices and 320 from control practices	No details of randomisation procedure. Follow-up of patients carried out by a nurse not responsible for delivering the intervention to the patient's practice. Power calculations reported for serum cholesterol change, distance walked and smoking. Comparison groups were similar at baseline. Loss to follow-up was 10% in intervention group and 9% in control group. Analysis was by intention to treat but excluded deaths	Patients registered with 67 general practices in a specified geographical area. Patients admitted to hospital with MI (71%) or with angina of recent onset (<3 months) seen in hospital (29%). Patients were judged well enough to participate by medical and nursing staff on the ward or in clinic	Specialist cardiac liaison nurses coordinated the transfer of care between hospital and general practice. The liaison nurse saw patients in hospital and encouraged them to see the practice nurse after discharge. Support was provided to practice nurses by regular contact, including a telephone call shortly before patient discharge to discuss care and book a first follow-up visit to the practice. Practice nurses were encouraged to telephone the liaison nurse to discuss problems or to seek advice on clinical or organisational issues. Each patient was given a patient-held record card which prompted and guided follow-up at standard intervals	No contact between specialist cardiac liaison nurses and general practices. Not explicitly stated, but understood to be no recommendation to see practice nurse and no patient-held record	Serum cholesterol, blood pressure, distance walked in 6 minutes and smoking cessation did not differ between groups. Body mass index was slightly lower in the intervention group. More patients in the intervention group attended at least one outpatient CR session compared with controls (42% vs 24%, $p < 0.001$). The difference was most marked in angina patients (42% vs 10%)		The programme providing coordinated follow-up care by specialist cardiac liaison nurses did not improve health outcomes, but was effective in promoting at least one outpatient CR session attendance

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Osika, 2001[82] UK (thesis)	Non-randomised study. One district with intervention (98 patients) and one district without (77 patients)	Groups similar at baseline	Post-MI patients invited to attend an outpatient CR programme. Mean age 72 years, 78% men	Home visiting by lay volunteers. Visitors were trained 5 hours per day for up to 7 days. Patients were visited for approximately 30 minutes each week for 6 weeks. Lay volunteers provided advice relating to rehabilitation and offered to accompany the patient to the first outpatient CR appointment	District with no lay volunteer visiting	Attendance at first outpatient CR appointment. In the district with lay volunteer visiting 71% of patients attended a first appointment at outpatient CR. In the control district 47% attended ($p = 0.02$). No difference in several clinical outcomes and indicators at first CR attendance		The lay volunteer home visiting service was associated with increased uptake of outpatient CR services
Krasemann and Busch, 1988[109] Germany (journal) Relates to attendance at an outpatient heart group after an inpatient CR programme	Non-randomised trial. 200 patients studied	Groups of patients attending in different periods. No information comparing groups at baseline. 156 patients followed up. Loss to follow-up 22%	All male patients post-MI	After completion of an inpatient CR programme patients were given a pamphlet with information about outpatient heart groups designed to motivate patients to join. The booklet contained general information about heart disease, including nutrition, exercise, relaxation and medication. Patients were also given the addresses of local outpatient heart groups	After completion of an inpatient CR programme patients were given the addresses of local outpatient heart groups	Number of patients who joined an outpatient heart group after 6 months. 78 patients were followed up in both the intervention and control groups. 66.5% of patients who received the intervention attended a heart group compared with 31.0% in the control group ($\chi^2 = 20$, df = 1, $p < 0.001$)		The authors report that the informative pamphlet used to motivate patients was associated with increased attendance at outpatient heart groups. Patients ranked sources of information: personal conversation with doctor, pamphlet, lectures, personal talks with caring persons and talks with other patients

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Mosca *et al.*, 1998[41] USA (conference abstract)	Before- and after-study. Comparison of outpatient CR participation rates in two 6-month periods with a total of 199 patients	No information on baseline characteristics of the two groups	All patients post-MI. Mean age 61 years, with 68% men	Critical care pathway prompting referral for outpatient CR	Before implementation of critical care pathway	Overall participation at outpatient CR was 54%, as determined by patient self-report. The critical care pathway was associated with a non-significant increase in outpatient CR participation (OR 1.9, 95% CI 0.6 to 5.5)		The authors conclude that a systems approach, involving a prompt for outpatient CR referral as part of a discharge critical care pathway, may potentially increase rates of participation in CR for women
Imich, 1997[110] UK (journal)	Before- and after-study. Comparison of 12-month audit periods	No information on the numbers of patients or baseline characteristics of the two groups	Post-MI and postcardiac surgery patients	Postdischarge, pre-outpatient CR home visits by trained community nurses. For MI patients this was 2–3 weeks after discharge and for heart surgery patients 4–5 weeks. Visits were aimed at: reduction of anxiety levels, enabling patients to make and maintain lifestyle changes, identifying problems or potential problems, and providing patients with support, education and counselling. The number and frequency of home visits were dependent on individual requirement	Patients discharged from hospital before the nurse home-visiting programme was instigated	Patient perception of the postdischarge home visiting service. Attendance at outpatient CR by invited patients increased from 55% before to 75% after instigation of the programme. As patient numbers are not given, the significance of this cannot be determined		Introduction of postdischarge home visits by trained community nurses reported to be associated with an increased attendance at outpatient CR

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Scott *et al.*, 2000[111] Australia (journal)	Before- and after-study. Comparison of clinical indicators in three periods: pre-intervention (133 patients), implement-ation of intervention (271 patients), and post-intervention (245 patients)	Pre- and postintervention groups were similar at baseline, but no information was reported for the intervention period. Outpatient CR programme was not fully operational in the preintervention period. Authors assumed that patient characteristics, diagnostic methods and treatment modalities would remain essentially unchanged throughout the study	Post-MI patients. Patient characteristics only available for pre- and postintervention groups. Mean age 66 years, 66% men	Dissemination of evidence-based clinical guidelines for the management of AMI to hospital staff and GPs. Information on clinical indicators was fed back to all hospital consultant physicians, senior emergency staff, medical service directors and senior clinicians. As part of the feedback the observed proportion of patients receiving the treatments was compared with a quality threshold or minimum level of utilisation indicative of a reasonable standard of care. Local providers could compare and improve their own practice	Before dissemination of evidence-based clinical guidelines	Clinical indicator changes pre- to postintervention. No changes were seen in β-blocker, aspirin or angiotensin converting enzyme inhibitor use. Lipid-lowering drug use increased from 23% to 56% ($p < 0.003$). Outpatient CR service became operational at start of intervention period and showed a steady increase in utilisation rate from 24% to 54% ($p = 0.003$)		The authors suggest that clinical guidelines combined with feedback of clinical indicators to health professionals were useful in improving quality of care, including outpatient CR utilisation in MI patients. However, the improvement may be due to parallel changes in levels of provision

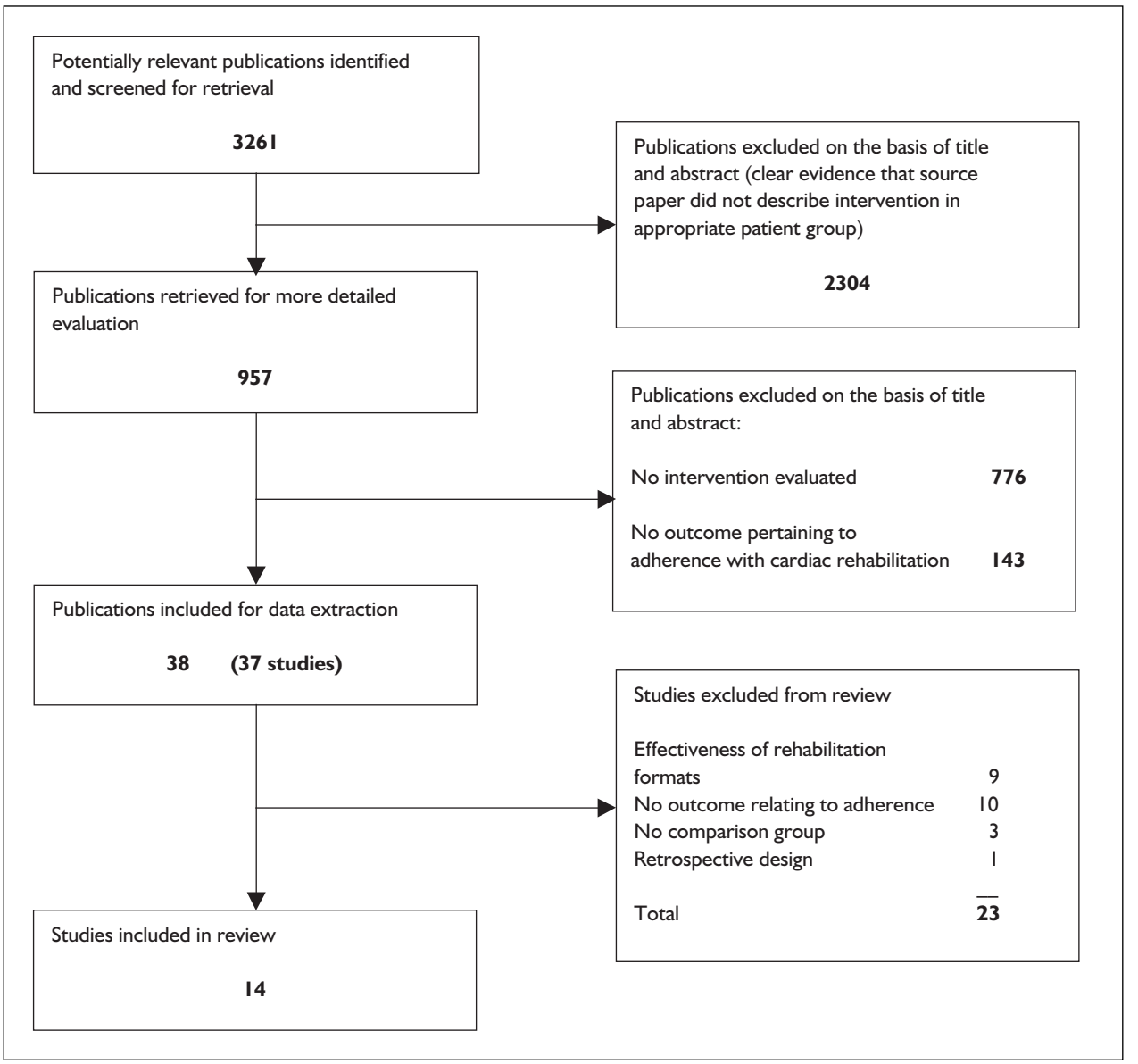
Appendix 9

Studies excluded from the review of interventions to improve uptake of cardiac rehabilitation

Authors, year	Intervention	Reason for exclusion
Campbell *et al.*, 1998[125,126]	Nurse-led clinic giving secondary prevention assessment and advice	Outcome: use of secondary prevention, not attendance at CR
Caulin-Glaser & Schmeizel, 2000[123]	Education of health professionals about CR	Outcome: referral not attendance
Feder *et al.*, 1999[127]	Leaflets promoting secondary prevention. Also general practices received letters summarising effective secondary prevention	Outcome: attendance at a general practice and drug prescribing, not CR
Foresman, 1997[120]	Telephone invitation to CR programme	No comparison group
Johnson, 2000[118]	Nurse telephone follow-up	No data: descriptive
Kalayi *et al.*, 1999[122]	Computerised referral pathway	Outcome: referral not attendance
Keck *et al.*, 1991,[113] Keck & Budde,1996[114]	Comprehensive motivation programme integrated into CR to improve attendance at heart group after inpatient CR	No data: descriptive
Levknecht *et al.*, 1997[116]	Outpatient clinical pathway	No outcome data: descriptive
McCarney *et al.*, 2000[119]	General practice database identifies patients for home visit by health visitor to improve secondary prevention	No data: descriptive
Mehta *et al.*, 2000[121]	Quality improvement initiative: critical care pathway, patient education tool and staff education	Retrospective study. Allocation to groups according to physician preference
Millar 1993[115]	Home visit by cardiac support worker	No data: descriptive
Pasquali *et al.*, 2001[112]	Telephone call describing CR benefits and assistance with referral	Out of review period
Suskin *et al.*, 2000[124]	Physician endorsement	Outcome: commitment to participate, not attendance
Tod *et al.*, 1998[117]	Integration of primary and secondary care	No outcome data: descriptive

Appendix 10

Flow diagram of the systematic review of interventions to improve adherence to cardiac rehabilitation (QUOROM statement flow diagram)



Appendix 11

Studies evaluating interventions to improve adherence to cardiac rehabilitation

Studies are listed in terms of study design and the hierarchy of evidence, with RCTs first.

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Oldridge & Jones, 1983[145] Canada (journal)	Parallel group RCT. 120 patients randomised. Patients stratified by smoking status, occupation, leisure habits and number of prior infarctions before randomisation. These variables were shown to be predictors of dropout based on previous experience of this group	Patients randomised using a list of random numbers. Method of allocation concealment unclear. Blind assessment of outcomes unclear. Unclear whether comparison groups were similar at baseline. Losses to follow-up (defined as non-attendance at eight consecutive rehabilitation sessions) were similar in the intervention and control groups (21% and 16%)	Mixed CHD patients, MI 73%, CABG 16%, angina 12%. Mean age 50.5 years, all men	Usual comprehensive cardiac rehabilitation programme, plus self-management techniques including an agreement to participate in the programme for 6 months to be signed by the patient and coordinator, and self-report diaries to complete and be discussed with the coordinator at regular intervals. Diaries included six graphs for plotting self-monitored submaximal heart rates each month, at 33%, 50% and 75% of the maximum power output achieved in the previous exercise test, and six 24-hour recall questionnaires of daily activities on a randomly chosen day to be completed each month. In addition, a weight loss diary to fill in each week was given to those who initially agreed to lose weight, and similar diaries to record number of cigarettes smoked each day. Follow-up at the end of the intervention period of 6 months	Usual comprehensive cardiac rehabilitation programme	Compliance defined as attendance at 60% or more of the scheduled 48 supervised cardiac rehabilitation sessions. (If any patient failed to attend four consecutive sessions they were contacted by telephone and urged to continue.) Data presented as intention to treat. Compliance rate was 54% in the intervention group, and 42% in the control group; these rates were not statistically significant. Attendance of dropouts was similar in the intervention and control groups (21% vs 16%) and was also similar for compliers (74% vs 76%). Not all patients in the intervention group signed the agreement to participate. Compliance was significantly higher in the 48 subjects who signed (65%), than in the 15 who refused (20%)		Overall, no improvement in compliance with rehabilitation sessions was seen in patients randomised to a programme of self-management techniques, including signed agreement and diaries. In a subgroup analysis, the author found higher compliance rates in those patients in the intervention group who signed the agreement to participate than in those who did not, and suggested the need for further investigation of self-management compliance-improving strategies

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Daltroy, 1985[146] USA (journal)	Parallel group RCT, 174 patients randomised	Method of randomisation and allocation concealment unclear. Outcome assessors were blind to group allocation, and comparison groups were similar at baseline. No losses to follow-up reported at 3 months, the period at which most data are presented. Study was powered to detect a 14% difference in attendance over 3 months	Mixed CHD patients, 81% MI, 63% with a history of angina, 17% post-CABG. Mean age 53.8 years, 88% men, 95% white	Oral persuasive communication and education intervention to improve patient adherence to exercise regimens. Intervention developed from interviews with previous patients and their spouses to elicit the most common beliefs of benefits and drawbacks to the exercise programme. Patients in the intervention group received an oral persuasive communication on the telephone in scripted counselling format to: convince them of the benefits of regular exercise, warn them of likely drawbacks so that expectations would be realistic, acquaint them with methods used by other patients to cope with drawbacks, and elicit an oral commitment to attend at least two classes per week for the first 6 weeks. In addition, patients received a mailed written persuasive communication to reinforce these points. Spouses also received telephone counselling to encourage the patient to attend and discuss methods that other patients spouses found useful. A written communication to reinforce these points was also sent to the spouse to increase the spouse's support. Patients also received a pamphlet with information on benefits and drawbacks of exercise. All communication was tailored to individual patients based on data collected by questionnaire at baseline	Comparison group patients and spouses received the same pamphlet with information on the benefits and drawbacks of exercise, as the intervention group. This was done so all patients would have the same inducement to enter the programme. It was thought unlikely that this single intervention would produce lasting behavioural change	Attendance at exercise sessions over 3 months. Attendance for patients in the intervention group was 63.8%, and 62.2% in the comparison group. Subgroup analysis revealed that among the intervention group, attendance was greater among better educated patients. Spouse participation, age, gender and occupation were not associated with attendance, although the numbers in these subgroups are likely to be too small to draw firm conclusions		Overall, no significant improvement in attendance at exercise sessions with the intervention. There is some suggestion that educational level is a factor associated with attendance

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Mahler *et al.* 1999[147] USA (journal)	Parallel group RCT, two intervention groups and one control group, 215 patients randomised	Method of randomisation and allocation concealment unclear. Blind assessment of outcomes unclear. Unclear whether comparison groups were similar at baseline, as demographic data are not presented separately for each group. Overall losses to follow-up at 3 months were 9%	Consecutive elective first time CABG, mean age 61.4 (3.2 years), 86.5% men, 83.3% white	Videotape intervention postsurgery, shortly before discharge to enhance compliance with exercise and diet. Two videotape interventions: (1) Mastery Tape: depicts patients as calm and confident at the time of hospital discharge, making steady progress with no complications during 6 months, and adjusting to the recommended exercise and low-fat diet with relative ease; (2) Coping Tape: edited so the same patients mention concerns they are experiencing about hospital release and cope with effort, but successfully, with a variety of difficulties (e.g. fatigue, diet changes), so the recovery is portrayed as a steady forward progression of ups and downs. Exercise and dietary compliance assessed at 1 and 3 months postdischarge	Standard discharge preparation from one of the two hospitals where recruitment took place. No attempt was made to interfere with this. Consisted almost exclusively of advice not to lift too much, and instructions regarding the importance of exercise and maintaining a low-fat diet	Compliance with lifestyle changes. Exercise compliance assessed with a simple questionnaire of leisure-time exercise (how many times in the past 7 days they participated in light, moderate and strenuous exercise). Dietary compliance was assessed from the cholesterol–saturated fat subscale of the diet habit survey. At 3 months exercise compliance was improved with both interventions ($p < 0.05$), but improvements were greatest for the Coping Tape at 1 month for moderate exercise, and at 3 months for strenuous exercise. Both intervention groups showed a reduction in dietary cholesterol and saturated fat at 1 month ($p < 0.05$), but no differences were seen at 3 months	Anxiety and self-efficacy beliefs. Hypothesised that these would affect compliance	The authors hypothesised that either tape would result in improved outcomes compared with control, but also that the Coping Tape would exhibit the highest self-efficacy beliefs and greatest compliance. They concluded that viewing either tape proved to be an effective method for increasing dietary and exercise compliance during the first 3 months postsurgery

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Aish & Isenberg, 1996[148] Canada (journal)	Parallel group RCT, 104 patients randomised	Method of randomisation and allocation concealment unclear. Comparison groups were similar at baseline. Blind assessment of outcomes unclear. Losses to follow-up not reported	MI patients, majority first MI. Patients recruited while in hospital. Mean age 62 (11) years, 60% men	Nursing intervention of nutritional self-care based on Orem's theory.[176] Home visit to collect baseline 3-day diet record, assess food habits and provide information about nutritional goals for healthy hearts, and determine whether these were being met. Suggestions for changes given and a commitment on the part of the patient sought to make these changes. Three follow-up telephone calls over 6 weeks and a further home visit to collect 3-day diet record and assess food habits at 7 weeks postdischarge. Data compared between baseline and 7 weeks postdischarge	Control group received follow-up telephone calls and home visit at 7 weeks to collect data on 3-day dietary record and assess food habits. Advice about diet was not given unless the patient introduced the subject	Adherence to dietary advice assessed from dietary record and food habits questionnaire. Total fat and saturated fat percentage of calories was significantly reduced in the intervention group ($p < 0.01$). Significant improvement on the food habits questionnaire was seen in the intervention group ($p < 0.05$)	Appraisal of self care and eating habits which showed improvement with the intervention, and self-efficacy for healthy eating, which showed no change with the intervention	The authors conclude that this nursing intervention was effective at supporting healthy eating and patients' self-care agency

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Ashe, 1993[149] USA (PhD thesis)	Quasi RCT, 41 patients randomised	Allocation to groups by presenting patients with a packet containing a form coded A or B. Blind assessment of outcomes unclear. Similarity of groups at baseline unclear. Overall losses to follow-up 22%	Subjects recruited from a phase 2 cardiac rehabilitation programme. Mixed cardiac patients including MI, CABG, angina and patients with valve problems. Mean age 62 (range 33–77) years, gender not mentioned, 95% white	Motivational relapse prevention intervention received during the course of the cardiac rehabilitation programme. The cardiac rehabilitation programme consisted of three weekly exercise sessions of 30–40 minutes over 2–3 months. The intervention was started after four or five exercise sessions. The intervention was based on Marlatt and Gordon's model.[177] Patients received individual sessions, one a week for 3 weeks. Session 1: using pretest information, factors found to interfere with adherence were introduced. Patients discussed their perceptions on the value of exercise, listed their goals for the programme and anticipated outcomes. Session 2: patients were introduced to decision-making concepts and cognitive interference factors. Discussion with regard to coping with 'slips' and introduction to appropriate ways to reframe perspectives. Patients filled in daily activity sheets. Session 3: focused on the importance of lifestyle balance. Patients were asked to refer to daily activity sheets to introduce concepts of shoulds and wants. Stressors were identified that may impact on lifestyle balance and discussed, as was the importance of positive thinking and use of medication. Patients also took part in a stress management exercise and relaxation procedure	During the course of the exercise programme patients received a 'benign' education intervention, which covered basic exercise concepts, guidelines for proper exercise participation, exercise tips and handouts, and the benefits of exercise	Total adherence to the maximum number of exercise sessions. This was 90% in the intervention group and 89% in the control group (not significant)	Various psychological measures used to determine relationships with attendance	Many hypotheses tested with relatively small number of patients. The authors conclude that they found no differences between groups on measures of adherence, self-motivation, self-efficacy or internal health locus of control

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Hopper, 1995[150] USA (PhD thesis)	Parallel group RCT, 80 patients randomised	No details of method of randomisation or allocation concealment. Blind assessment of outcomes unclear. Groups similar at baseline. 46% loss to follow-up.	Mixed CHD patients: 49% MI, 16% CABG, 3% angioplasty, 8% MI and CABG, 10% MI and angioplasty, 15% MI, CABG and angioplasty. Mean age 58 years, 83% men	During the 12 months following cardiac rehabilitation patients received monthly structured telephone interviews with a cardiac nurse or an exercise physiologist from the rehabilitation team. Interviews provided social support and encouragement, lasted for about 15 minutes, and addressed the areas of consistent exercise, maintenance of a healthy diet, consistency with medication, knowledge of current blood pressure and cholesterol levels, and symptoms that required medical attention. Health professionals provided assistance if immediate care was required. Postal questionnaire follow-up 12 months after completion of CR programmes	No support or telephone calls after CR from rehabilitation staff	Exercise habit, intention to exercise and conditions that facilitated or discouraged the performance of exercise assessed by self-completed questionnaire. No difference in exercise habit or intention to exercise associated with the intervention. Conditions that facilitated the performance of exercise were improved in the intervention group compared with control (p <0 .05)	Exercise confidence scale (self-efficacy), personal attitudes scale (depression), resting and exercise blood pressure, blood lipids and graded maximal exercise test. No differences between intervention and control	The author concludes that personal independence of participants after a CR programme can be improved by means of telephone contact conducted after conclusion of the programme

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Duncan *et al.*, 2001[151] USA (conference proceedings)	Parallel group RCT, eight patients randomised. Feasibility study, hence small numbers	No details of method of randomisation, allocation concealment, blinding of outcome assessors, comparability of groups at baseline or losses to follow-up	Heart failure patients who were currently participating in a cardiac rehabilitation programme. No details of age or gender, mean ejection fraction 24%	Cardiac rehabilitation plus behavioural feedback intervention on dietary sodium intake. Feedback given on a 3-day dietary log of sodium intake, discussion of problem-solving strategies to reduce future sodium intake	Patients in the rehabilitation programme completed the 3-day dietary log on sodium intake	Repeat of the 3-day dietary log of sodium intake at the end of the intervention period, and completion of the beliefs about diet instrument (measure of benefits and barriers related to dietary sodium adherence). Sodium intake was significantly less in the intervention group (1569 vs 2836 mg, $p < 0.05$), and these patients identified significantly fewer barriers to adhering to sodium recommendations		Very small feasibility study with only four patients randomised to each group. Intervention of behavioural feedback had positive effects on sodium intake and attitudes towards adherence to recommended sodium levels
Leslie & Schuster, 1991[152] USA (journal)	Quasi RCT, 30 patients randomised	Alternate allocation to intervention or control. Blind assessment of outcomes unclear. The comparison groups were similar at baseline in terms of age and gender but there were more CABG and fewer MI patients in the control group. There was a 7% overall loss to follow-up over an 8-week period	Mixed CHD patient: MI 25%, CABG 43%, angioplasty 18%, other coronary disease 14%. Mean age 55.6 years, 71% men	Contingency contracting. Contracting in this study is defined as a written contract negotiated with the patient, stating how long they will exercise for to maintain their heart rate at a certain level, on how many days that week, in return for a reward. Patients chose rewards that were generally acceptable providing they were not damaging to health. Examples included dietary recipes, T-shirts or loan of exercise equipment. All contracting done by the education coordinator of the cardiac rehabilitation programme, with sessions lasting for 10 minutes each week for 8 weeks. Contract behaviours were designed to be attainable, and exercise sessions were routinely scheduled three times a week. Upon completion of the contract patients received their reward. Patients also received 1 hour of formal education each week. Follow-up assessment at 8 weeks	Patients in the comparison group received the same 1 hour per week of formal education as the intervention group	Exercise knowledge test and adherence to exercise sessions. There was a significant increase in exercise knowledge scores at 8 weeks in the intervention group, but no difference in attendance rates between the intervention and control groups (90% and 89%, respectively)		There was no effect of the intervention on programme attendance. The authors conclude that the increase in exercise knowledge suggests that the contingency contracting process may be an intervention worthy of consideration in addition to traditional group lectures

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Miller *et al.*, 1988[143] Miller, *et al.*, 1989[144] USA (journals)	Quasi RCT. 115 patients randomised	Alternate allocation to intervention or control. Blind assessment of outcomes unclear. The comparison groups were similar at baseline. There was an 11% overall loss to follow-up over a 60-day period, and 30% loss to follow-up at 1 year	All patients recruited from in patient cardiac rehabilitation programmes (one of three similar programmes) following a first uncomplicated MI. Age range 30–65 years, 81% men. Data available for only those patients followed up, not all those randomised	All patients had 10–15 days of cardiac rehabilitation in hospital, including advice on diet, activity, smoking and medication. At 30 days postdischarge nurses visited patients at home to deliver an intervention to improve medical regimen adherence which consisted of three steps: (1) Assessment: data obtained on patient self-assessment of attitudes and perceived beliefs of others towards regimen compliance, personal psychological and societal adjustments, and reported regimen compliance by patient and spouse, predischarge and 30 days postdischarge. (2) Problem identification: data from step 1 were evaluated by the patient, spouse and nurse. Problem areas were defined and factors contributing to non-compliance were discussed. (3) Goal setting: on the basis of problems identified, alternative actions were discussed and a health plan with specific goals was developed. Assessment of compliance with medical regimen at follow-up home visits at 60 days and 1 year	All patients had 10–15 days of cardiac rehabilitation in hospital, including advice on diet, activity, smoking and medication. Patients interviewed before discharge and visited at home 30 days postdischarge to collect assessment data as for the intervention group. Assessment of compliance with medical regimen at follow-up home visits at 60 days and 1 year	Compliance with medical regimen, divided into diet, smoking, activity, stress and medications. Various health behaviour and attitude scales used to assess this. No significant differences were seen between intervention and control groups at 60 days or 1 year postdischarge		The authors conclude that no differences were found between the intervention or control groups for medical regimen adherence. The authors observed that attitudes and perceived beliefs of others were predictive of adherence and should be included in any rehabilitation programme. Repeated self-evaluation questionnaires and nurse visits may have acted as an intervention in the control group

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Lack, 1985[153] USA (PhD thesis)	Quasi RCT, 48 patients randomised, data presented for 34 completers	Patients randomly assigned to intervention or control as they presented themselves. On occasions where there were insufficient numbers to form an intervention group, the authors departed from their standard randomisation and priority was given to the intervention group, hence this group is larger ($n = 22$ vs $n = 12$). Blinding of outcome assessors unclear. Comparison groups were similar at baseline. Overall losses to follow-up 29%	Patients referred to cardiac rehabilitation. Mixed CHD patients: 62% MI, 24% CABG, 15% both. Mean age 59 (range 28–72 years), 86.8% men	12-week psychotherapy intervention and its impact on patient compliance with prescribed regimen in the cardiac rehabilitation setting. Patients received the intervention when they first started the cardiac rehabilitation session. Intervention consisted of 90-minute sessions once a week for 3 months, or 12 or 15 sessions of insight-orientated group psychotherapy. The primary focus was to help the group to communicate thoughts and feelings with the associated affects. The therapist created an atmosphere that was supportive, cooperative and goal directed. The secondary focus was to highlight and promote change in those behaviours and styles of relating that reflected a maladaptive control orientation, e.g. hesitancy or refusal to comply with physician recommendations, or resistance to group participation. Period of follow-up at end of intervention period of 3 months	Control group received usual cardiac rehabilitation	Physiological markers of compliance with exercise (heart rate and blood pressure). Attendance at prescribed exercise sessions, and self-report of exercise at home: rated as poor (once a week for less than 20 minutes or none, score 0–1), good (three times a week for 20–30 minutes, score 2) or excellent (more than three times a week for more than 30 minutes, score 3). Mean scores for self-report measures of compliance were 2.57 and 2.37 for the intervention and control groups, respectively, over the 3 month period. The intervention group attended 88.4% of the prescribed exercise sessions, the control group 75.7% ($p < 0.05$)		The authors conclude that the analyses showed no effect of the psychotherapy intervention on patient compliance measured by physiological or self-report measures. They did, however, demonstrate that patients receiving the intervention attended significantly more prescribed exercise sessions

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Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Marshall *et al.*, 1986[154] USA (journal)	Non-randomised trial, 60 patients studied	Data were collected from controls first ($n = 30$) and then intervention patients ($n = 30$). Comparison groups were similar at baseline. Sampling was prospective and inclusion criteria were specified. Losses to follow-up not reported	CABG patients. Elective CABG performed by the same group of surgeons. Mean age 59 (range 46–78 years), 70% men	Structured teaching programme to increase patients' knowledge and compliance to medication, diet, smoking cessation and exercise post surgery. Teaching guide developed by nurses with considerable experience with this patient group, and used by nurses. Follow-up assessment at 4–6 weeks postsurgery	Received teaching by unstructured method	Compliance with diet, medication, smoking cessation and activity, and knowledge. Compliance assessed by self-report. Patients were assigned a score on follow-up visit of compliance based on individual risk factors. Overall compliance scores were 86.8 in the intervention group, and 79.5 in the control group ($p < 0.05$). Compliance was better in the intervention than in the control group for activity (15.6 vs 7 blocks walked, $p < 0.005$). None of the patients in the intervention group reported non-compliance with any of the risk factors measured	Knowledge scores post surgery were similar for the structured and unstructured teaching groups	The authors conclude that overall compliance and activity levels were significantly higher postsurgery in the structured teaching group
Huerin *et al.*, 1998[155] Argentina (conference proceedings)	Non-randomised trial, 509 patients studied, intervention group $n = 229$, control group $n = 280$	Comparison groups were similar at baseline and sampling was prospective. No further details are given	Patients with CHD. Mean age 56 (SD 10) years, 67.5% men	Traditional rehabilitation and an adherence strategy which included a signed commitment to rehabilitation, family involvement, sports and recreational activities to increase patient commitment and involvement in a variety of activities, and three weekly talks on CHD-related topics. Follow-up at 12, 24 and 52 weeks	Traditional rehabilitation	Compliance expressed as relative risks, defined as attendance at 66% or more sessions. 12 weeks, RR 2.3 (95% CI 1.8 to 2.9), 24 weeks, RR 2.9 (2.3 to 3.7), 52 weeks, RR 4.25 (3.2 to 5.6) (log-rank test between strategies $p < 0.001$)		The authors conclude that at each time-point, the adherence strategy group showed significantly better compliance with cardiac rehabilitation

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
McKenna *et al.*, 1998[156] UK (conference proceedings)	Two study designs: non-randomised trial, exercise vs. standard rehabilitation, and an evaluation of a women-only programme compared with historical controls. No information on patient numbers	No more details presented about how the studies were conducted	MI patients, mean age 62 years, 75% men. Mean age of the women-only group was 60 years	Two interventions examined. (1) Low-intensity exercise to increase compliance, offered to patients who were previously unable to take part in standard exercise owing to co-morbidity. The comparison group were standard rehabilitation. (2) Women-only groups: compliance with rehabilitation. Historically compliance in women with standard rehabilitation was 6%	Standard rehabilitation	Attendance at cardiac rehabilitation. Attendance was 82% in the low-intensity exercise group and 34% in the standard rehabilitation comparison group. Attendance in the women-only group was 75%		The authors conclude that tailored exercise for different patient groups increased compliance with the exercise component of standard rehabilitation. Patient numbers not reported. The magnitude of changes cannot be assessed
Erling & Oldridge, 1985[157] Canada (conference proceedings)	Before- and after-study	Prospective sampling, inclusion criteria not specified. No other details about how the study was conducted	CHD patients. No other details	Spousal support programme: spousal participation in cardiac rehabilitation. Not all spouses attended, so comparators are baseline before spouse participation ($n = 30$), spouse participation in cardiac rehabilitation ($n = 30$) and no spouse participation ($n = 30$). Follow-up at 6 months	Patient compliance before introduction of the spouse support programme	Attendance at cardiac rehabilitation sessions defined as those who attended at least 50% of the sessions. Before the spousal intervention attendance was 44%, after the spousal support programme where the spouse participated in rehabilitation patient attendance was 90% ($p < 0.001$), and where the spouse did not attend this was 67%		The authors conclude that even for patients whose spouses did not attend rehabilitation there were beneficial effects of group support when the spousal programme was running compared with the prespousal programme

Appendix 12

Studies excluded from the review of methods to improve adherence to cardiac rehabilitation

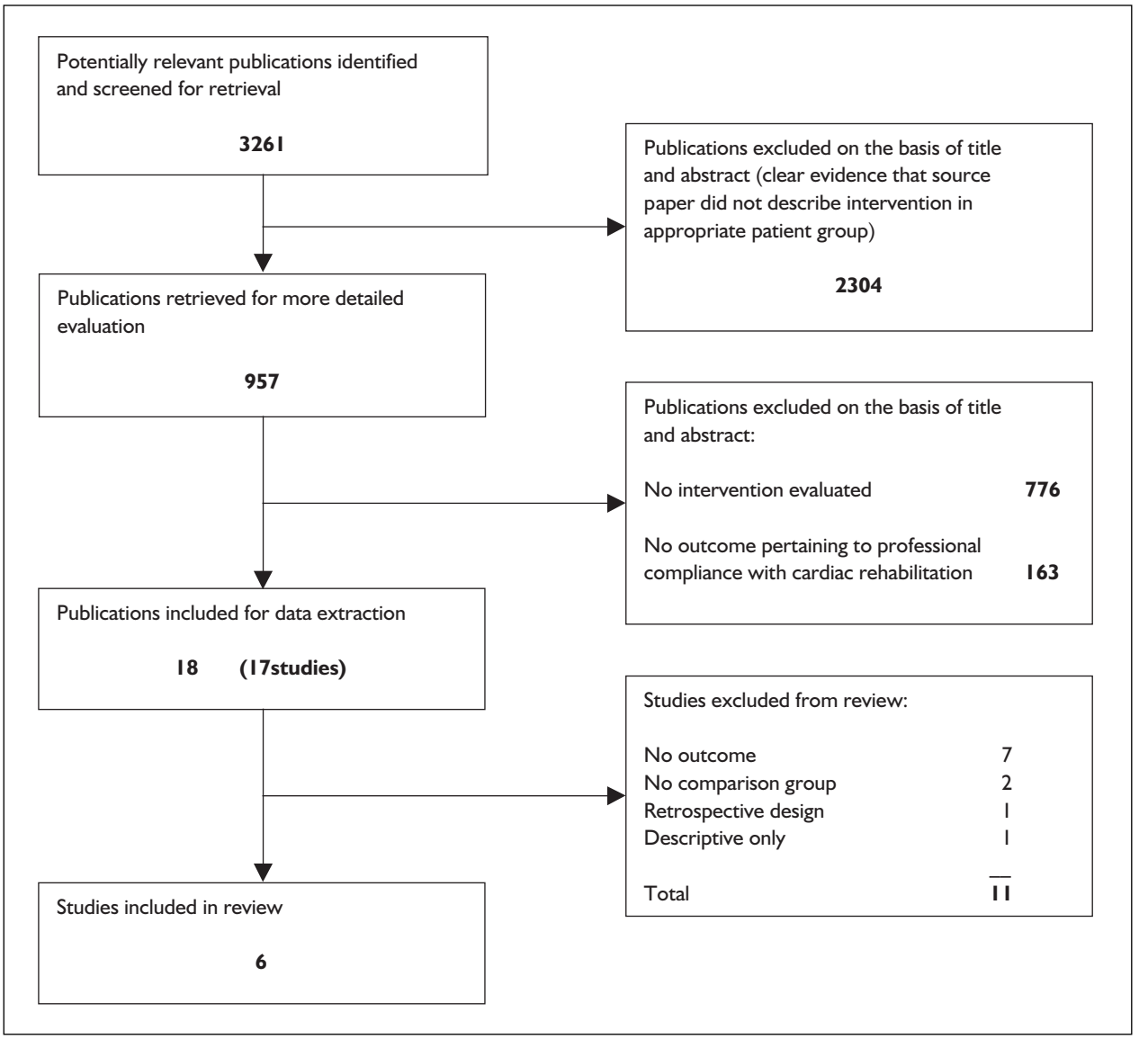
Authors, year	Intervention	Reason for exclusion
Ades *et al.*, 2000[134]	Home-based telephone-monitored CR compared with outpatient CR	Authors report on effectiveness of CR formats. Patients were not randomised but allocated to home-based telephone monitored CR if living in remote area or unable to attend outpatient CR due to work or time constraints
Baile & Engel 1978[173]	Follow-up of non-compliant coronary care unit patients	No comparison group
Barnason & Zimmerman, 1995[167]	Postdischarge telephone follow-up or group teaching	No relevant outcome
Blumenthal *et al.*, 1988[159]	Comparison of high- and low-intensity exercise training	Comparison of rehabilitation intensities. Authors report on effectiveness. RCT of patients representative of most US CR programmes
Brubaker *et al.*, 1996[160]	Comparison of standard and extended length CR	Comparison of rehabilitation duration. Authors report benefit from continuing CR for >1 year. Retrospective non-randomised comparison of patients who attended 3 months or >1 year of CR
Campbell *et al.*, 1998[126]	Nurse-run clinics in general practice	No relevant outcome
Carlson *et al.*, 2000[73]	Comparison of traditional and partly home-based CR	Comparison of rehabilitation formats. Authors report increased total exercise sessions with partly home-based programme. Randomised trial
DeBusk *et al.*, 1985[131]	Comparison of home and group exercise training	Comparison of rehabilitation formats. Authors report on effectiveness. Randomised trial
Dracup *et al.*, 1984[162]	Group counselling	No relevant outcomes.
Gordon & Haskell, 1997[168]	Physician-supervised, nurse case-manager CR model	No comparison group. No relevant outcomes
Labrador *et al.*, 1998[169]	Physician-directed, nurse-supervised case-management programme	No relevant outcomes
Lee *et al.*, 1996[161]	Comparison of high- and low-intensity exercise training	Comparison of rehabilitation intensities. Authors report on effectiveness. Randomised trial
Linde & Janz, 1979[164]	Postoperative teaching programme	No relevant outcomes
Mehta *et al.*, 2000[121]	Quality improvement initiative: critical care pathway, patient education tool and staff education	Retrospective study. Allocation to groups according to physician preference
Penckofer & Llewellyn, 1989[163]	Comparison of education by structured and unstructured methods	Comparison of education interventions. Authors report little extra benefit from structured teaching. Not randomised
Senaratne *et al.*, 2001[171]	Lipid management by cardiac rehabilitation nurse	Outside search period. No relevant outcome
Skof *et al.*, 2001[172]	Comparison of late outpatient and inpatient CR	No relevant outcome

continued

Authors, year	Intervention	Reason for exclusion
Sparks *et al.*, 1993[158]	Home-based telephone-monitored CR compared with outpatient CR	Comparison of rehabilitation formats. Authors report on effectiveness. Randomised trial.
Starkey *et al.*, 2000[175]	Computer-facilitated secondary prevention programme	No comparison group
Stern & Cleary, 1981[174]	Low-level exercise programme	No comparison group
Unden *et al.*, 1993[165]	Nurse support	No relevant outcome
Vale *et al.*, 2000[170]	Telephone coaching by dietitian	No relevant outcome
van Elderen *et al.*, 1994[166]	Group health education programme	No relevant outcome

Appendix 13

Flow diagram of the systematic review of interventions to improve professional compliance with cardiac rehabilitation (QUOROM statement flow diagram)



Appendix 14

Studies evaluating interventions to improve professional compliance with cardiac rehabilitation

Studies are listed in terms of study design and the hierarchy of evidence, with RCTs first.

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Jolly, *et al.*, 1999[104] UK (journal) Also Bradley *et al.*, 1997[102] and Jolly *et al.*, 1998[103]	67 general practices randomised within strata (by fund-holding status, distance from local CR programme and number of whole-time partner equivalents), 277 patients from randomised intervention practices and 320 from control practices	No details of randomisation procedure. Follow-up of patients carried out by a nurse not responsible for delivering the intervention to the patient's practice. Power calculations reported for serum cholesterol change, distance walked and smoking. Comparison groups were similar at baseline. Loss to follow-up was 10% in intervention group and 9% in control group. Analysis was by intention to treat but excluded deaths	Patients registered with 67 general practices in a specified geographical area. Patients admitted to hospital with MI (71%) or with angina of recent onset (<3 months) seen in hospital (29%). Patients were judged well enough to participate by medical and nursing staff on the ward or in clinic	Specialist cardiac liaison nurses co-ordinated the transfer of care between hospital and general practice. The liaison nurse saw patients in hospital and encouraged them to see the practice nurse after discharge. Support was provided to practice nurses by regular contact, including a telephone call shortly before patient discharge to discuss care and book a first follow-up visit to the practice. Practice nurses were encouraged to telephone the liaison nurse to discuss problems or to seek advice on clinical or organisational issues. Each patient was given a patient-held record card which prompted and guided follow-up at standard intervals	No contact between specialist cardiac liaison nurses and general practices. Not explicitly stated, but understood to be no recommend-ation to see practice nurse and no patient-held record	Serum cholesterol, blood pressure, distance walked in 6 minutes and smoking cessation did not differ between groups. Body mass index was slightly lower in the intervention group. More patients in the intervention group attended at least one outpatient CR session compared with controls (42% vs 24%, $p < 0.001$). The difference was most marked in angina patients (42% vs 10%)		The programme providing coordinated follow-up care by specialist cardiac liaison nurses did not improve health outcomes, but was effective in promoting at least one outpatient CR session attendance

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Suskin *et al.*, 2000[124] Canada (conference abstract)	RCT, 50 patients randomised	No information on randomisation procedure or baseline characteristics of the two patient groups	Post-MI patients. 76% men	Written endorsement by attending physician	Generic endorsement	Self-reported commitment to participate in CR was 62% in those who received the physician endorsement compared with 38% in those receiving a generic endorsement ($p = 0.08$)	No effect of method of delivery (in-person vs not)	The authors suggest further study required to evaluate whether physician endorsement improves CR participation
Kalayi *et al.*, 1999[122] UK (journal)	Before- and after-study. Comparison of CR referral rates before intervention (298 patients) and after intervention (263 patients)	No information on baseline characteristics of the two patient groups	Post-MI patients. No information on age or gender of groups	Electronic referral pathway with feedback to ward staff on referral rates. The referral pathway was initiated when a CR referral screen was automatically flagged up on the electronic patient record of those patients with a discharge diagnosis of MI	Before implementation of referral pathway intervention	After intervention referral increased from 194/298 (65%) to 208/263 (79%) ($p = 0.0002$)	Monthly referral rate at start of study 15/37 (40%). Within 3 months of intervention monthly referral 35/39 (90%)	The authors note that as well as improving patient care the use of electronic referral and feedback of referral rates was of benefit to staff, saving time referring and identifying patients
Mosca *et al.*, 1998[41] USA (conference abstract)	Before- and after-study. Comparison of outpatient CR participation rates in two 6-month periods with a total of 199 patients	No information on baseline characteristics of the two groups	All patients post-MI. Mean age 61 years, 68% men	Critical care pathway prompting referral for outpatient CR	Before implementation of critical care pathway	Overall participation at outpatient CR was 54%, as determined by patient self-report. The critical care pathway was associated with a non-significant increase in outpatient CR participation (OR = 1.9, 95% CI 0.6 to 5.5)		The authors conclude that a systems approach, involving a prompt for outpatient CR referral as part of a discharge critical care pathway, may potentially increase rates of participation in CR for women

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Caulin-Glaser & Schmeizel, 2000[123] USA (conference abstract)	Before- and after-study. Comparison of outpatient CR participation rates in two 5-month periods. Patient numbers not specified	No information on baseline characteristics of the two patient groups	Post-revascularisation patients. No information on age or gender of groups	Educational intervention for healthcare providers on the comprehensive nature and benefits of CR, with particular emphasis on women. Consisted of grand rounds for medical and nursing staff, monthly review of health outcomes and cost-effectiveness of CR with clinical cardiology council, placement of CR information in examination offices, and instructions for nurses to discuss CR with patients and encourage discussion of referral with physicians	Before implementation of educational intervention	In-hospital referral increased by 50% ($p < 0.05$). Physician office referral increased by 61% ($p < 0.05$). Male and female referral rates increased by 41% ($p < 0.05$) and 65% ($p < 0.05$), respectively		The authors conclude that appropriately designed educational interventions are successful in altering behaviours of healthcare personnel and improving referral to CR

continued

Authors, year and country (publication type)	Study type and size	Study quality	Participants' case-mix, % men, mean age (SD), ethnicity if stated	Intervention: details including setting, staff involved, intensity, follow-up period for outcome assessment	Comparison group: details of usual care	Principal outcome measure and results	Other outcomes and results	Comments: authors' conclusions, interesting features
Scott *et al.*, 2000[111] Australia (journal)	Before- and after-study. Comparison of clinical indicators in three periods: preintervention (133 patients), implementation of intervention (271 patients) and postintervention (245 patients)	Pre- and postintervention groups were similar at baseline, but no information was reported for the intervention period. Outpatient CR programme was not fully operational in the preintervention period. Authors assumed that patient characteristics, diagnostic methods and treatment modalities would remain essentially unchanged throughout the study	Post-MI patients. Patient characteristics only available for pre- and postintervention groups. Mean age 66 years, 66% men	Dissemination of evidence-based clinical guidelines for the management of AMI to hospital staff and GPs. Information on clinical indicators was fed back to all hospital consultant physicians, senior emergency staff, medical service directors and senior clinicians. As part of the feedback the observed proportion of patients receiving the treatments was compared with a quality threshold or minimum level of utilisation indicative of a reasonable standard of care. Local providers could compare and improve their own practice	Before dissemination of evidence-based clinical guidelines	Clinical indicator changes pre- to postintervention. No changes were seen in β-blocker, aspirin or angiotensin converting enzyme inhibitor use. Lipid-lowering drug use increased from 23% to 56% ($p < 0.003$). Outpatient CR service became operational at start of intervention period and showed a steady increase in utilisation rate from 24% to 54% ($p = 0.003$)		The authors suggest that clinical guidelines combined with feedback of clinical indicators to health professionals were useful in improving quality of care, including outpatient CR utilisation in MI patients. However, the improvement may be due to parallel changes in levels of provision

Appendix 15

Studies excluded from the review of interventions to improve professional compliance with cardiac rehabilitation

Authors, year	Intervention	Reason for exclusion
Axtell *et al.*, 2001[191]	Inclusion of pharmacist in MI care	Outcome: use of medication
Campbell *et al.*, 1998[125,126]	Nurse-led clinic giving secondary prevention assessment and advice	Outcome: use of secondary prevention, not attendance at CR.
Feder *et al.*, 1999[127]	General practices received letters with summary of effective secondary prevention with reference to local guidelines. Also prompts to patients	Outcomes: attendance at a general practice and drug prescribing, not CR
Hillert *et al.*, 2000[192]	Risk factor management through physician education, participation and consensus development	No comparison group
Levknecht *et al.*, 1997[116]	Outpatient clinical pathway	No outcome data: descriptive
Linde & Janz, 1979[164]	Nurse training to master's level in postoperative teaching programme	Inpatient programme. Outcome: patient knowledge and follow-up. Data not interpretable
McCarney *et al.*, 2000[119]	General practice database identifies patients for home visit by health visitor to improve secondary prevention	No data: descriptive
Mehta *et al.*, 2000[121]	Quality improvement initiative: critical care pathway; patient education tool and staff education	Retrospective study. Allocation to groups according to physician preference
Senaratne *et al.*, 2001[171]	Lipid management by cardiac rehabilitation nurse	Outside search period. Outcome: lipid levels
Starkey *et al.*, 2000[175]	Computer-facilitated secondary prevention programme	No comparison group
Tod *et al.*, 1998[117]	Integration of primary and secondary care	No outcome data: descriptive

Appendix 16

Estimates for unit costs for different staff categories and grades

Staff category	Costs (£)						
	Salary[a]	Salary on-costs	Over-heads[b]	Capital costs[c]	Total hours worked per year[c]	Staff costs per hour[d]	Total costs per hour
Staff nurse B grade	11,820	1,507[e]	2,216	1,288	1,575	8	11
Staff nurse E grade	18,222	2,323[e]	2,216	1,288	1,575	13	15
Staff nurse F grade	21,010	2,679[e]	2,216	2,263	1,575	15	18
Staff nurse G grade	23,948	3,053	2,216	2,263	1,575	17	20
Staff nurse H grade	26,540	3,384[e]	2,216	2,263	1,575	19	22
Physiotherapist helper	10,865	1,130	2,216	2,775	1,584	8	11
Physiotherapist basic	17,202.50	2,193[f]	2,216	4,302	1,512	13	17
Physiotherapist senior I	23,452	2,990	2,216	4,302	1,512	17	22
Physiotherapist senior II	20,670	2,635[f]	2,216	4,302	1,512	15	20
Physiotherapist superintendent III	25,832.50	3,294[f]	2,216	4,302	1,512	19	24
Physiotherapist superintendent IV	23,452.50	2,990[f]	2,216	4,302	1,512	17	22
Sport scientist	22,767.50	2,903[f]	2,216	4,302	1,512	17	21
Exercise physiologist (MTO 3)	20,647	2,632[f]	2,216	4,302	1,512	15	20
Occupational therapist basic	17,202.50	2,193[g]	2,216	4,302	1,512	13	17
Occupational therapist senior I/II	21,785	2,778	2,216	4,302	1,512	16	21
Occupational therapist head	26,467.50	3,375[g]	2,216	4,302	1,512	20	24
Dietitian	21,785	2,778[e]	2,216	3,606	1,554	16	20
Dietitian senior I/II	23,452.50	2,990[e]	2,216	3,606	1,554	17	21
Pharmacist	32,983.50	4,205[e]	2,216	3,606	1,554	24	28
GP	NA	NA	NA	NA	NA	54	62
Medical consultant	67,064	9,664	24,320	4,161	1,640	47	64
Clinical psychologist	38,316	5,364	3,978	2,144	1,476	30	34
Cardiac technician (MTO 4)	25,118	3,203[e]	2,216	4,302	1,512	19	23
Social worker	19,951	2,709	3,399	2,007	1,554	15	18
Secretary	NA	NA	NA	NA	NA	10	13

[a] Salaries information from www.nhscareers.nhs.uk, March 2002.[197] Salaries are based on the midpoint of the relevant scale prevailing at 1 April 2001, except for GP, medical consultant, secretary and social worker (source: Netten *et al*., 2001[196]). All costs are given as 2000/01 values (overheads, capital overheads).

[b] Comprise estimates for indirect overheads (administrative services) (source: Netten *et al.*[196]). Indirect overheads for all other staff for which Netten *et al.*[196] do not provide estimates are assumed to be the same as for staff in the same group.

[c] Based on Netten *et al*.[196] Capital overheads for all other staff for which Netten *et al.*[196] do not provide estimates are assumed to be the same as for staff in the same group.

[d] Comprises only salary and salary on-costs.

[e] On-costs are estimated assuming the same on-costs/salary ratio as for staff nurse G grade.

[f] On-costs are estimated assuming the same on-costs/salary ratio as for physiotherapist senior I.

[g] On-costs are estimated assuming the same on-costs/salary ratio as for occupational therapist senior I/II.

MTO, medical technical officer.

Appendix 17

List of equipment

Costs of equipment for outpatient cardiac rehabilitation (phase 3), are shown below. (Source: cardiac rehabilitation programme, Bristol Royal Infirmary.) All prices include VAT.

Life Fitness upright cycle LC9100	£2770.65
Cardiosport watches 'Cardiosport Go' (×15)	£375.41
Reebok step (×2)	£78.00
Physio Med Rehab Bouncer	£57.57
Yellow Theraband exercise roll (50 yards)	£38.77
York Probells in carry case (×2)	£19.90
Theraband exercise ball (Antiburst) (45 cm) (×2)	£19.97
Pro Fitness exercise mats (×15)	£89.85
Physio Med rehab support rails	£46.94
Theraband exercise ball (Antiburst) (55 cm) (×2)	£27.02
Duflex deluxe Gym Mate	£82.19
	Total: £3606.27 (VAT included)

Appendix 18

Staff input: average hours per week

TABLE 42 *Average hours per week by staff category for centres in group 1 (more than five key staff)*

Staff category	Centre 1.1	Centre 1.2	Centre 1.3	Centre 1.4	Centre 1.5	Centre 1.6	Centre 1.7	Centre 1.8	Centre 1.9	Centre 1.10
Nursing grade										
B										
E										
F	20.0	37.5		18.5				37.5		
G			38.0	37.5	37.5	26.0		37.5		37.5
H	37.5	37.5					18.0		37.5	
Physiotherapist										
Helper										
Basic									2.0	
Senior I		9.0	4.0	10.0	49.5		3.0	18.0		7.0
Senior II										
Superintendent III						26.0				
Superintendent IV	6.0									
Sport scientist										
Exercise physiologist		37.5	0.5							
Occupational therapist										
Basic									1.0	7.0
Senior			7.0			6.0	8.0	2.0		
Head	6.0									
Dietician					4.0		0.32			0.33
Senior dietitian	0.33	0.16	1.0	0.2		3.0		1.0	0.125	
Pharmacist	0.5	0.16	1.0	0.16	1.0	0.12	0.16	1.0	0.125	0.33
Physician[a]	0.15	0.2		0.41	3.0		0[b]			
Clinical psychologist		0.75	4.0	0.16	0[b]	0.5			1.0	0.33
Cardiac technician			3.0							4.0
Social worker								1.0		
Secretary			25.0			2.0	10.0	5.0		
Total	**70.4**	**122.8**	**83.5**	**67.2**	**95.0**	**67.6**	**39.5**	**103.0**	**41.8**	**56.5**

[a] Includes cardiologists, consultants, clinical assistants and GPs.
[b] Centres indicated the contribution of these staff groups in their questionnaire, but stated that their contribution was rather advisory and did not include any time involvement.

TABLE 43 *Average hours per week by staff category for centres in group 2 (three to five key staff)*

Staff category	Centre 2.1	Centre 2.2	Centre 2.3	Centre 2.4	Centre 2.5	Centre 2.6	Centre 2.7	Centre 2.8	Centre 2.9	Centre 2.10
Nursing grades										
B			9.5							
E			15.0					37.5		19.5
F	22.5	75.0					30.0			
G			75.0	10.0	2.0			37.5		37.0
H						37.5			20.0	
Physiotherapist										
Helper				6.0						14.0
Basic										
Senior I	10.0	4.0	11.0	6.0		2.0				21.0
Senior II					2.0		12.0			
Superintendent III										
Superintendent IV										
Sport scientist							6.0		13.0	
Exercise physiologist										
Occupational therapist										
Basic										
Senior				0.5						
Head										
Dietitian	0.25		0.25			0.15		0.16		1.0
Senior dietitian		3.0			0.62				1.0	
Pharmacist	0.25	1.0	0.25	0.5	0.32	0.04	1.0	0.16		
Physician[a]				0.5			7.01			
Clinical psychologist		3.0								
Cardiac technician		4.0								
Social worker							16.0			
Secretary			12.0		0.35				30.0	8.0
Total	**33.0**	**90.0**	**123.0**	**23.5**	**5.3**	**39.7**	**72.0**	**75.3**	**64.0**	**100.5**

[a] Includes cardiologists, consultants, clinical assistants and GPs.

TABLE 44 *Average hours per week by staff category for centres in group 3 (two or fewer key staff)*

Staff category	Centre 3.1	Centre 3.2	Centre 3.3	Centre 3.4	Centre 3.5	Centre 3.6	Centre 3.7	Centre 3.8	Centre 3.9	Centre 3.10
Nursing grade										
B										
E										
F										30.0
G	4.0	52.5	21.0	2.0		12.0			1.0	
H					4.0					
Physiotherapist										
Helper										
Basic										
Senior I	14.0		6.0				2.0	1.0		4.0
Senior II				4.0	2.0	6.0				
Superintendent III										
Superintendent IV										
Sport scientist										4.0
Exercise physiologist										
Occupational therapist										
Basic										
Senior	1.0						2.0			
Head										
Dietitian										
Senior dietitian										
Pharmacist										
Physician[a]										
Clinical psychologist										
Cardiac technician			5.0							
Social worker										
Secretary						3.0				
Total	**18.0**	**53.5**	**32.0**	**6.0**	**6.0**	**21.0**	**4.0**	**1.0**	**1.0**	**38.0**

[a] Includes cardiologists, consultants, clinical assistants and GPs.

Appendix 19

Referral, uptake and completion rates for 30 randomly selected UK cardiac rehabilitation programmes in 2000

	Group 1[a] (*n* = 10)	**Group 2[b] (*n* = 10)**	**Group 3[c] (*n* = 10)**
Hours per patient	29.0 (8.9) *27.0* (21–48)	24.0 (8.6) *21.5* (15–38)	20.0 (12.3) *17.5* (6–48)
Patients referred to CR	282.4 (169.5) *289.5* (84–578)	352.5 (244.5) *255.5* (130–855)	170.7 (142.5) *150* (3–400)
Patients joined CR	157.3 (97.6) *148.0* (46–381)	194.3 (104.7) *171.5* (73–429)	97.9 (73.3) *103.5* (2–216)
% of referrals	55.7 *51.1*	55.1 *67.1*	57.3 *69.0*
Patients completed CR	126.3 (90.4) *104.5* 39–319	158.1 (100.8) *150.5* 44–392	88.8 (67.2) *92.5* 2–195
% of referrals	44.7 *36.0*	44.8 *58.9*	52 *61.6*

Data are shown as mean (SD) and median (in italics) (range).
[a] Centres with more than five key staff.
[b] Centres with three to five key staff.
[c] Centres with two or fewer key staff.

Appendix 20

Average cost estimates for cardiac rehabilitation (detailed table)

Costs (£)	Group 1[a] (*n* = 10)		Group 2[b] (*n* = 10)		Group 3[c] (*n* = 10)	
	Staff costs only	**Total costs**	**Staff costs only**	**Total costs**	**Staff costs only**	**Total costs**
Per year/centre	53,087 (18,251) *51,323* (26,658–85,869)	72,676 (25,485) *69,834* (37,183–118,299)	42,125 (24,059) *43,337* (3,607–78,526)	57,353 (32,146) *58,362* (5,932–105,763)	12,383 (12,688) *8,400* (714–38,157)	17,638 (16,752) *12,797* (1,888–50,886)
Per patient referred	243 (143) *175* (88–441)	330 (177) *245* (123–587)	137 (92) *113* (28–357)	186 (120) *156* (45–470)	127 (94) *105* (10–254)	249 (243) *156* (16–660)
Per patient joined	421 (187) *466* (159–777)	571 (246) *639* (221–948)	236 (167) *212* (36–651)	320 (217) *293* (59–856)	174 (132) *118* (26–382)	324 (299) *192* (44–944)
Per patient completed	542 (225) *553* (224–846)	738 (298) *750* (314–1118)	317 (228) *259* (48–716)	429 (295) *354* (79–947)	186 (133) *139* (26–382)	344 (295) *230* (44–944)
Per patient completed/hour	20 (9) *20* (5–33)	27 (12) *27* (7–45)	14 (11) *11* (1–38)	20 (14) *15* (2–49)	14 (15) *7* (1–40)	30 (41) *10* (1–110)

Data are shown as mean (SD) and median (in italics) (range).
[a] Centres with more than five key staff.
[b] Centres with three to five key staff.
[c] Centres with two or fewer key staff.

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We look forward to hearing from you.

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