

Is provision and funding of cardiac rehabilitation services sufficient for the achievement of the National Service Framework goals?

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Abstract

The objectives of this analysis were to ascertain the population need for out-patient cardiac rehabilitation in England, to estimate the current level of provision and associated costs, to identify economies of scale in service provision and to investigate budgetary implications of extending provision.

Discharge statistics from the Hospital Episode Statistics database (HES) in England in the year 2000, and data from centres contributing to the British Association for Cardiac Rehabilitation (BACR) survey were analysed. A short follow-up questionnaire was sent to respondents of the BACR survey.

The main outcome measures were: the number of patients eligible for cardiac rehabilitation; the

percentage referred, joining and completing programmes; health service costs associated with current levels of provision; elasticity of costs; and costs associated with expanding services.

Using an inclusive definition of need, about 267,000 people required cardiac rehabilitation in England in the year 2000. This figure fell to 100,000 if services were restricted to those aged below 75 years with acute myocardial infarction, unstable angina or following revascularisation. Health service costs per patient completing a programme were £354 (staff) and £486 (total). Out-patient cardiac rehabilitation represented a NHS cost of approximately £12.5–19.0 million per annum. A 1% increase in patients completing a programme is estimated to lead to a 0.25% fall in the staff cost per patient. A budget increase of 630% would be necessary to treat all eligible patients using moderate staffing configurations, which would fall to 170% if only those aged below 75 years with restricted diagnoses were to be treated.

We conclude that a substantial proportion of the population need for cardiac rehabilitation goes unmet and that achievement of current targets for provision is likely to require considerable additional resources. Reconfiguration of service provision towards less complex services would enable more patients to be treated. Current information systems in cardiac rehabilitation services are inadequate to provide indicators of performance and monitoring.

Key words: National Service Frameworks, cardiac rehabilitation, cost, cost analysis.

Abridged article reference (*Br J Cardiol* 2004;**11**:307–09)

Introduction

Coronary heart disease is the leading single cause of death and one of the major causes of life loss before the age of 65 years. The economic burden to the UK health care system was esti-

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mated to be £1.73 billion in 1999, with total annual costs including productivity and informal care of £7.06 billion.¹

Cardiac rehabilitation aims to facilitate recovery after a cardiac event and to enable patients to achieve and maintain better health.² A recent Cochrane systematic review concluded that cardiac rehabilitation is effective in reducing cardiac deaths, cardiovascular morbidity and primary risk factors.³ Exercise-based cardiac rehabilitation and a comprehensive cardiac rehabilitation intervention were found to reduce total cardiac mortality by 31% (odds ratio [OR] 0.69; 95% confidence intervals [CI] 0.51 to 0.94) and 26% (OR 0.74; 95% CI 0.57 to 0.96), respectively. There is limited evidence on the cost-effectiveness of cardiac rehabilitation, however. The only formal cost-effectiveness study of comprehensive cardiac rehabilitation after myocardial infarction we have been able to identify was conducted in the US. It suggested a cost of \$6,800 per quality-adjusted life year (QALY) gained and \$21,800 per life year gained (1991 prices),^{4,5} equivalent to £6,900 per QALY and £15,700 per life year gained (1994/95 prices).⁶ These estimates are within the bounds of other interventions considered cost-effective.⁷

In recognition of this, the National Service Framework for Coronary Heart Disease (NSF for CHD) in England 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 and that, when high quality services are available to these patients, those with angina and heart failure should be included.⁷ However, surveys have suggested that uptake of out-patient cardiac rehabilitation is low.^{8,9} Many patients who stand to benefit do not currently receive adequate rehabilitation.⁷ Moreover, there is a considerable variation in funding for cardiac rehabilitation across the country, with some programmes not having a designated budget.^{10,11} This has resulted in calls for higher and more consistent funding in order to provide cardiac rehabilitation to all eligible patients and to meet NSF for CHD targets.¹¹

In order to quantify the shortfall in cardiac rehabilitation service availability and uptake, reliable estimates of need, provision, current costs and costs associated with increased provision are required. We used hospital discharge statistics and surveys of cardiac rehabilitation centres to examine the cost implications of increasing provision to meet population need.

Methods

Population need

Data from the Hospital Episode Statistics database (HES) (Source: Department of Health) identified all patients in England, discharged alive from hospital between 1st April 1999 and 31st March 2000 with a primary diagnosis of ischaemic heart disease (ICD10 codes I20-25) in the subcategories: acute myocardial infarction (ICD10 code I21); heart failure (ICD10 code I50); unstable angina (ICD10 code I20.0); coronary artery bypass graft (OPCS4 codes K40-K46); and percutaneous transluminal coronary angioplasty (OPCS4 codes K49-K50).

Alternative definitions of need were then conceptualised by applying the following four criteria of eligibility for cardiac rehabilitation: all patients with ischaemic heart disease (IHD) or revascularisation; only patients with acute myocardial infarction, unstable angina or revascularisation; patients less than 75 years of age with ischaemic heart disease or revascularisation; and patients less than 75 years of age with acute myocardial infarction, unstable angina or revascularisation.

Cardiac rehabilitation uptake

Existing data from the British Association for Cardiac Rehabilitation (BACR) annual survey of UK cardiac rehabilitation services conducted in 2000^{9,10} provided limited information on the staff type (but not grade or the number of staff) and the number of hours worked. A supplementary questionnaire was sent to respondents of the BACR survey to address specific issues of uptake by under-represented groups (e.g. women, elderly people and black and ethnic groups) and the duration and the number and length of sessions for each of the major component parts of rehabilitation (i.e. exercise, health education and psychological interventions). Relevant data for this study from the two sources related to numbers of patients referred, joining and completing out-patient cardiac rehabilitation, staff time per week and the number and length of sessions per week and per course. Data were entered into a Microsoft Access database and analysed using STATA (Version 7).

The level of service provision in England, in terms of the total numbers of patients referred, joining and completing cardiac rehabilitation, was estimated by aggregating the numbers given by responding centres. Where a centre had not responded, a value relating to the upper inter-quartile range derived from the responding centres was imputed and added to the aggregated figures of the responding centres in order 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 inter-quartile range 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.

Health service costs

Costs associated with out-patient cardiac rehabilitation were calculated by considering staff, overheads, building capital and equipment costs. Programmes that provided information on staff input (n=145; 66% of the 220 programmes in England identified by BACR) were stratified by the multi-disciplinarity of staff input as a proxy for service quality. Seven professional categories relevant to cardiac rehabilitation (physician, nurse, physiotherapist/ sport scientist, occupational therapist, psychologist, dietician, pharmacist) were designated as key staff. Three service quality groups were defined: group 1 had more than five different types of key staff; group 2 had three to five types; and group 3 had two or fewer. Ten programmes from each

Table 1. Estimated level of provision in England (total number of cardiac rehabilitation programmes n=220)

	Mean	SD	Median	IQR	Number of programmes	Sum of patients	Number of non-responding programmes	Estimated total number of patients*
Number of patients referred to CR	349.0	244.3	279	180–450	117	40,840	103	59,380–87,190
Number of patients joining CR	208.6	141.8	177.5	112–277	114	23,781	106	35,653–53,143
Number of patients completing CR	153.1	94.8	130	88–197	98	15,010	122	25,745–39,043

Key: CR = cardiac rehabilitation; SD = standard deviation; IQR = interquartile range
*Numbers estimated by imputing interquartile range for non-responding centres

group were chosen at random and detailed information on weekly hours and staff grades was collected. The midpoint of the relevant pay scales prevailing on 1st April 2001, including employers' on costs and the number of hours worked per annum, were used to estimate the hourly pay rate. This was applied to the number of hours worked per week to give the associated staff cost.

Non-staff-related costs refer to the overheads, building capital and equipment costs associated with the running of cardiac rehabilitation services. However, most cardiac rehabilitation services tend to use a number of different facilities to deliver the different components of the programme and so were not able to provide estimates of non-staff-related costs. Therefore, we applied 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) used by Netten *et al.*¹²

A list of required equipment, based on current recommendations from the BACR, and their associated costs were obtained from a local NHS Trust. An equivalent annual equipment cost of £861 (VAT included) was derived by using an annuity factor of 6% and assumed life span of five years.

Direct overheads, i.e. 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% to 18% (midpoint 11%) of total costs.^{13–15}

Budget analysis

The total cost of cardiac rehabilitation, the cost per patient completing rehabilitation and the cost per hour were estimated for each of the 10 programmes within each group and an average was derived for the group. A national weighted average cost was derived using the proportion of centres falling within each group based on the BACR data.

The annual budget attributable to cardiac rehabilitation was estimated for England from the number of patients completing a cardiac rehabilitation programme and the weighted total average cost per patient completing the programme. The addi-

tional funding needed to increase coverage was explored for different service groups and eligibility criteria.

We also looked at whether the unit cost per patient completing cardiac rehabilitation would fall if the number of patients completing the rehabilitation programme increased. The log-transformed costs and log-transformed number of patients completing cardiac rehabilitation were plotted and a simple log-linear regression model fitted, with costs per patient completing the programme as the dependent variable and annual numbers of patients completing the programme as the independent variable. We also estimated a model controlling for numbers of staff employed in cardiac rehabilitation. The regression coefficient for the number of patients in these log-linear regression 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

Table 1 gives the estimated level of service provision in England. Between 59,800 and 87,200 patients were referred, between 35,700 and 53,100 patients joined and between 25,700 and 39,000 patients completed cardiac rehabilitation.

Need and provision

Table 2 shows the number of patients eligible for cardiac rehabilitation. With a diagnosis of IHD (including heart failure and angina pectoris) as an eligibility criterion, 266,833 patients were eligible. Data from the supplementary survey imply that 22–33% were referred, with 13–20% attending. If the eligibility criterion was restricted to patients with acute myocardial infarction, unstable angina or following revascularisation then 131,089 were eligible, with 45–67% referred and 27–41% attending. Restricting cardiac rehabilitation to those under 75 years, and to the smaller range of discharge diagnoses resulted in 59–87% referred and 36–53% attending.

Cardiac rehabilitation service and costs

Data from the main BACR survey suggested that the majority of cardiac rehabilitation programmes had three to five key staff (72.6%), 20.4% had more than five and 7% had two or fewer.

Table 2. Number of patients eligible for cardiac rehabilitation and estimated referral, uptake and adherence**

Eligible patients*	Number of patients	Proportion of patients referred to CR (%)	Proportion of patients joining CR (%)	Proportion of patients completing CR (%)
All patients with primary diagnosis of IHD	266,833	22–33	13–20	10–15
All patients discharged with AMI, CABG, PTCA, UA	131,089	45–67	27–41	20–30
All patients with primary diagnosis of IHD < 75 years	202,001	29–43	18–26	13–20
All patients discharged with AMI, CABG, PTCA, UA < 75 years	99,888	59–87	36–53	26–39

Key: IHD = ischaemic heart disease; AMI = acute myocardial infarction; CABG = coronary artery bypass graft; PTCA = percutaneous transluminal coronary angioplasty; UA = unstable angina

*Source: Hospital Episode Statistics (HES) data, Department of Health

**Numbers estimated by imputing interquartile range for non-responding programmes

Table 3. Average hours per week by staff category in 30 programmes

Staff grades (n=10)	Group 1* (n=10)	Group 2** (n=10)	Group 3† (n=10)
Nurse grade			
B		1.0	
E		7.2	
F	11.4	12.8	3.0
G	21.4	16.2	9.3
H	13.0	5.8	0.4
Physiotherapist			
Helper		2.0	
Basic	0.2		
Senior I	10.0	5.4	2.7
Senior II		1.4	1.2
Superintendent III	2.6		
Superintendent IV	0.6		
Sport scientist		2.0	
Exercise physiologist	3.8		0.4
Occupational therapist			
Basic	0.8		
Senior	2.7	0.1	0.3
Head	0.6		
Dietician	0.5	0.2	
Senior dietician	0.6	0.5	
Pharmacist	0.5	0.4	
Physician	0.4	0.8	
Clinical psychologist	0.7	0.3	
Cardiac technician	0.7	2.0	0.5
Social worker	0.1		
Secretary	4.2	5.0	0.3
Total (SD)	74.7 (5.8)	62.6 (4.7)	18.0 (2.9)

*Group 1: programmes with more than five key staff

**Group 2: programmes with three to five key staff

†Group 3: programmes with two or fewer key staff

Table 4. Service provision, referral, uptake and completion rates for 30 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	27.0	24.0	21.5	20.0	17.5
Number referred	282.4	283.0	352.5	255.0	170.7	150.0
Number joined	157.3	148.0	194.3	172.0	97.9	104.0
% of referrals	56	51	55	67	57	69
Number completed	126.3	104.0	158.0	150.0	89.0	92.0
% of referrals	45	36	45	59	52	62

*Group 1: programmes with more than five key staff

**Group 2: programmes with three to five key staff

†Group 3: programmes with two or fewer key staff

had higher levels of staff input per week (75 hours) compared to group 2 (62 hours) or group 3 (18 hours). Table 4 shows that group 1 centres provide the most intensive service, with an average duration of 29 hours per patient compared with 24 hours for group 2 and 20 hours for group 3. The average number of patients referred to, joining and completing cardiac rehabilitation per group varied widely, with the highest numbers of patients being in group 2.

The average staff and total costs of cardiac rehabilitation are shown for each group in table 5. The 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 total costs for centres in groups 1 and 2 and 70% in group 3. The weighted average costs per patient completing a cardiac rehabilitation programme were £354 (staff costs only) and £486 (total costs).

The average number of hours worked by staff category and grade for each centre is shown in table 3. Centres in group 1

Table 5. Average cost estimates for cardiac rehabilitation

Costs (£)	Group 1* (n=10)		Group 2** (n=10)		Group 3† (n=10)		Weighted cost estimate	
	Staff costs only	Total costs	Staff costs only	Total costs	Staff costs only	Total costs	Staff costs only	Total costs
Per year/centre‡	53,087 (26,658–85,869)	72,676 (37,183–118,299)	42,125 (3,607–78,526)	57,353 (5,932–105,763)	12,383 (714–38,157)	17,638 (1,888–50,886)	42,300	57,700
Per patient completed‡	542 (224–846)	738 (314–1,118)	317 (48–716)	429 (79–947)	186 (26–382)	344 (44–944)	354	486
Per patient completed/hour‡	20 (5–33)	27 (7–45)	14 (1–38)	20 (2–49)	14 (1–40)	30 (1–110)	15	22

*Group 1: programmes with more than five key staff
**Group 2: programmes with three to five key staff
†Group 3: programmes with two or fewer key staff
‡Range in brackets

Table 6. Estimated budget requirements in £ million (% of current budget) to provide cardiac rehabilitation to all eligible patients

Eligible patients¶	Number of patients	Budget requirements‡ to rehabilitate all eligible patients uniformly in programmes with staff configurations of:		
		Group 1*	Group 2**	Group 3†
All patients with primary diagnosis of IHD	266,333	197 (1,150)	115 (630)	92 (480)
All patients discharged with AMI, CABG, PTCA, UA	131,089	97 (510)	56 (260)	45 (290)
All patients with primary diagnosis of IHD < 75 years	202,001	149 (850)	87 (450)	69 (340)
All patients discharged with AMI, CABG, PTCA, UA < 75 years	99,888	74 (370)	43 (170)	34 (120)

Key: IHD = ischaemic heart disease; AMI = acute myocardial infarction; CABG = coronary artery bypass graft; PTCA = percutaneous transluminal coronary angioplasty; UA = unstable angina
¶Source: Hospital Episode Statistics (HES) data, Department of Health
‡In £ million, % increase of estimated current budget in brackets
*Group 1: programmes with more than five key staff
**Group 2: programmes with three to five key staff
†Group 3: programmes with two or fewer key staff

Estimated current budget

Given that 26,000–39,000 patients completed cardiac rehabilitation, with a weighted average cost per patient of £486, we estimate a cardiac rehabilitation budget in England in 2000 of £12.5–19.0 million. If all services were modelled on the most common configuration of staffing (group 2), approximately 4,300 more patients could be treated with the same annual budget, but if the simpler group 3 services were to be uniformly provided, approximately 13,400 more patients could be treated. This corresponds to a 13% and 40% increase in coverage, respectively, compared to the current situation.

Budget increase

Table 6 shows the budget requirements to rehabilitate all potentially eligible patients. If all 266,833 IHD patients were considered eligible, an annual budget of approximately £115 million, a

630% increase, would be required to provide cardiac rehabilitation with the staff configuration of group 2. This would fall to £43 million if only those aged below 75 years with restricted diagnoses were treated. Similarly, budget increases range from 360–1,150% and 120–480% if eligible patients were to be treated in cardiac rehabilitation programmes with staff configurations of group 1 and group 3, respectively.

Economies of scale

The simple regression between numbers of patients treated and cost per patient showed no significant relationship. Controlling for staffing patterns in groups 1 to 3, however, showed a shallow inverse relationship between costs and numbers completing cardiac rehabilitation within each group. Results of this model, shown in table 7, suggest that cardiac rehabilitation centres experience economies of scale when dif-

Table 7. Regression model for staff costs per patient completing cardiac rehabilitation (in costs), controlling for group

	β	s.e.	95% CI	p
Constant	7.33	0.592	6.11 to 8.55	<0.000
In number 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	<0.000

$R^2=0.44$, $n=30$, $F=6.66$, $p<0.002$

Key: β = regression coefficient; R^2 = proportion of the variation explained by the model; F = statistics used to test joint significance of all parameters; s.e. = standard errors

ferent levels of multi-disciplinarity of staff input are taken into account. The regression equation shows that a 1% increase in patients completing the programme was associated with a 0.25% fall in the staff cost per patient.

Discussion

Despite recent efforts to promote provision and uptake of cardiac rehabilitation,^{8,7,11} this study suggests that NSF for CHD targets in England are far from being met. This finding is in concordance with previous research examining the relationship between need and supply. For example, Bethell *et al.* found that only 17% of all myocardial infarction, 44% of all CABG and 6% of all PTCA patients received cardiac rehabilitation in the UK in 2000.⁹

We estimated the health service costs per patient completing cardiac rehabilitation to be £486 of which staff costs account for £354 (2000/01 prices). The figures vary however, depending on the duration of the programme and staffing configurations. The estimates are consistent with previous studies which suggest that the costs of cardiac rehabilitation per treated patient are in the region of £200–500.^{16,18} Several explanations have been provided to explain the wide variation in direct costs found in these studies, such as the setting, components and type of programme.^{8,17}

We also found that programmes with more than five different key staff provided a more expensive service per patient due to a higher staff/patient ratio and longer programme duration. Although the heterogeneity of cardiac rehabilitation services has long been acknowledged, evidence is lacking to suggest that programmes with greater multi-disciplinarity improve patient outcomes.³

Although we had to make a number of simplifying assumptions to estimate current provision and associated costs as well as the budgetary implications of extending the provision of cardiac rehabilitation, our study demonstrates that considerable additional resources are required to meet national targets as set out in the NSF for CHD. To achieve NSF for CHD targets, a bud-

get increase of up to 630% is suggested. This would allow all patients with a discharge diagnosis of ischaemic heart disease to be treated uniformly in programmes with a moderate service quality (three to five key staff).

Study limitations

Our study has several limitations. Patients managed at home and in private hospitals are not included in the HES database. In calculating population need we assumed that each finished consultant episode equated to one person and that the ratio of spells to finished consultant episodes approximates to one.¹⁹ We assumed also that each admission represented a need for rehabilitation. Consequently, discharge diagnoses might represent a slight over-estimate of eligibility, as the time between two admissions might not be sufficient for enrolment in rehabilitation.

We were only able to estimate the current level of service provision indirectly. Therefore, the actual level of under-provision will depend upon the conceptualisation of need. Our broadest eligibility criteria assumed all patients with a primary diagnosis of ischaemic heart disease were eligible for cardiac rehabilitation. Under provision was still apparent, however, with more limited criteria of need.

Not all programmes could provide information on the number of patients referred to, joining and completing cardiac rehabilitation. However, the resulting estimates should provide a reasonable range within which the actual figures lie as we imputed the interquartile range to take account of missing data.

The inability of some programmes to provide comprehensive activity data was due to the lack of automated systems to extract these data, the lack of audit facilities, or programmes being in the process of installing systems to collect audit data to satisfy the requirements of the NSF for CHD. Further improvement of data collection by using modern medical records systems and by providing appropriate training for dedicated staff and dialogue between all contributors to services should improve this situation in the future.

A more appropriate approach would be to obtain information on the number of patients referred to, joining and completing cardiac rehabilitation stratified by gender, age and discharge diagnosis direct from cardiac rehabilitation centres and relate these to data that represent need. This would include the HES or information obtained from hospitals in the catchment area of the rehabilitation service, by means of comprehensive coronary heart disease registers.

We made several attempts to obtain estimates of non-staff-related costs directly from cardiac rehabilitation programmes involved in our study. These data, however, are not readily available from financial departments since cardiac rehabilitation services are rarely provided in a designated facility. We did not have the additional resources to conduct a more detailed costing study of all 30 cardiac rehabilitation programmes. Although further refinement of these cost estimates might be helpful in the future, given the scale of necessary investment required to

meet population need, our overall findings are unlikely to be modified.

Our study confirms the finding that cardiac rehabilitation programmes experience economies of scale, as reported by Gray and colleagues,¹⁷ suggesting that increasing the coverage of cardiac rehabilitation could lead to a less than proportionate increase in the cost per patient completing cardiac rehabilitation. In our analysis, this was only apparent, when we controlled for multi-disciplinarity of staff input. We did not take account of economies of scale in our estimates of budgetary requirements as only 16% of all programmes reported any spare capacity. In order to meet population need, additional new programmes will be required. These will incur an initial minimum level of expenditure for staffing, equipment and facilities, even if the annual throughput of patients is quite low.¹⁷ Moreover, cardiac rehabilitation services are currently provided in a number of settings including the hospital, the community and the patient's home, but the appropriate mix of service provision is unknown.⁸ Once again, given the scale of necessary investment required to meet population need, our overall findings are unlikely to be modified.

Implications and further research

This study attempted to specify resource implications of providing cardiac rehabilitation to match need and to meet NSF for CHD targets. The local costs of resources will depend on current staffing, the opportunity costs of extending roles of existing staff, existing (spare) capacity and facilities and, if not available, the costs of facilities. Further work is required to examine the best use of 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.

Our analysis was based on the assumption that the provision of cardiac rehabilitation services is either hospital- or community-based. A recent report by Dalal and Evans suggests that integrating secondary and primary care services, including offering patients home rehabilitation, can contribute to the achievement of NSF for CHD goals.⁸ However, the effectiveness of home rehabilitation compared with conventional programmes is not established. Furthermore, home interventions are not cost neutral and require provision of materials to patients and a cardiac liaison nurse to coordinate services and follow-up.²¹ Activities in the study of Dalal and Evans resulted in an overall cost of about £60,000 to rehabilitate approximately 100 patients per year.²⁰ This is equivalent to the annual cost of an average hospital-based programme.

Any funding initiatives, such as the Department of Health statement in 2001/2002 announcing a recurrent £100 m for cardiac and associated clinical programmes,²² should come with an identifiable budget for cardiac rehabilitation to avoid services being dependent on goodwill and vulnerable to fluctuation.¹¹ Poorly funded centres have little time to argue their case for a fair share of the funding, exacerbated by their lack of secretarial support to record their activities.



Key messages

- Uptake of cardiac rehabilitation services in England by eligible patients is low
- The cost associated with cardiac rehabilitation varies considerably, depending on staff configurations in programmes
- Reconfigurations towards less complex services would enable more patients to be treated
- Meeting current national targets as set out in the NSF requires considerable additional resources, varying from 170% to 630% of current spending depending on the quality of services provided

Acknowledgements

We thank Roy Maxwell and Davidson Ho for compiling data from the Hospital Episode Statistics. We also thank all cardiac rehabilitation centres that responded to the BACR/BHF survey. The University of Bristol is the lead centre for the MRC Health Services Collaboration.

Contributors

SE, KR, FT, RT, RW, JB and MB devised the original research and obtained funding. IG collected and analysed the data. IG drafted and edited the paper; SE and JB revised it. All authors contributed comments and corrections on the final draft. IG will act as the guarantor for the study.

Funding

NHS HTA Project No. 99/21/02.

Conflicts of interest

None declared.

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