

# The cost of cardiac rehabilitation services in England and Wales

**ABSTRACT**—A random sample of 25 cardiac rehabilitation programmes in England and Wales was surveyed by questionnaire. Using workload and resource data returned, costs were calculated per centre, per patient and per session. Sixteen (64%) of the centres returned full details. Annual staffing costs per cardiac rehabilitation centre were in the range £10,000 to £62,000, with a mean of just under £33,000 (median £32,000). Mean cost per patient completing the rehabilitation programme was £370 (median £223), and mean cost per patient per session was £47 (median £26). There was substantial intercentre variation in costs. Cost per patient was closely related to patient throughput and hours of contact time. The costs of rehabilitation programmes in this survey exceed earlier estimates. To assess the implications for the cost-effectiveness of such programmes, reliable data on the effectiveness of such programmes are now required.

Currently approximately half the health districts in the UK have no established cardiac rehabilitation programme, and rates of referral to such programmes of patients with myocardial infarction admitted to general medical wards are often very low [1]. It has been recommended that every major district hospital treating patients with heart disease should provide some form of cardiac rehabilitation service [2]. Hence, there is an urgent need to assemble information on the costs and cost-effectiveness of such services. At present, little is known about the economic aspects of these services [3]. A working party on cardiac rehabilitation services estimated that the costs of rehabilitation in 1992 varied between £4 and £15 per patient per session [2], but details of these estimates were not published. Accounts from an individual UK cardiac rehabilitation unit suggest that the average cost per case in 1993 was approximately £200 per year, depending on staffing levels, the range of equipment available, and the number of sessions in a routine rehabilitation course [4]; how typical this is of other UK units is not known.

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## Methods

A questionnaire survey identified 199 centres in England and Wales providing some form of cardiac rehabilitation service, 25 of which were randomly chosen to take part in a more detailed questionnaire survey (23 hospital-based, one community-based, one home-based). This sample was broadly representative of all centres in terms of size (average number of patients entered into programmes: 168 in all centres, 197 in sample) and of the occupational groups co-ordinating the programme (80% nurses in all centres, 84% nurses in sample). The sample included centres from all the main geographical areas of England; eight were attached to teaching hospitals and the remaining 17 to district general hospitals (DGHs). A researcher visited each centre and interviewed key staff to elicit information about the programme (Table 1) [5]. Costs were analysed from the perspective of the health service, and do not include costs accruing to the patient, such as travelling.

## Data

Twenty-three centres provided information on workload and resources, but six of them, which staffed the rehabilitation service by extension of physiotherapy, coronary care and other staff roles, did not receive specific funding and could not provide more detailed information on staff inputs. Another centre was unable to provide details of the number of patients entered into the programme. The costing was therefore based on 16 (64%) of the 25 cardiac rehabilitation centres surveyed.

The cost of staff employed in each rehabilitation centre was calculated by multiplying the average weekly number of hours worked by each grade of staff by the hourly average pay for that grade, with pay calculated as the mid-point of the relevant scale. All pay scales are based on pay rates prevailing at 1 October 1994 and include employer's costs. No information was collected on non-staff costs; most rehabilitation services do not operate as individual cost centres, and therefore such non-staff costs could not easily be collected without carrying out some field-work. In the accounts presented by Turner [4], staff costs accounted for exactly 80% of all costs, with the remainder almost evenly split between non-staff running costs and the capital and depreciation costs of equipment. In the survey reported here, costs relate only to staffing, and have been presented in terms of:

1. The total annual running cost of each centre.
2. The average cost per patient enrolled in and completing a rehabilitation programme.
3. The cost per patient per session.

## Results

Some aspects of services provided by the centres in the survey are shown in Table 2. The annual number of patients accepted was 30–573 (mean 197), and the drop-out rate was 1–25% (average 12%). No centre accepted all categories of patients with coronary heart disease, and only two accepted those who required close supervision, such as patients with heart failure or unstable angina.

The main components of the programme in all centres were education and exercise, but centres varied in the assessments and equipment available. Only two offered all five possible assessment procedures listed in the questionnaire (blood pressure measurement, electrocardiography, echocardiography, thallium perfusion scanning, radionuclide imaging), the average being three. No centre had all six pieces of equipment listed in the questionnaire (resuscitation equipment, oxygen, electrocardiogram, sphygmomanometer, peak flow meter, echocardiogram); mean

**Table 1. Information collected at each centre about the cardiac rehabilitation programme**

- structure of the programme, its content, organisation, staffing and funding
- workload and resources
- annual number of patients entering and completing the programme
- number of times per week that patients attend the centre
- length of each session
- total number of weeks attended
- staff funded to work on the rehabilitation service, their weekly hours and grades
- equipment available to the centre
- other diagnostic and test procedures routinely used

number available 4. All the programmes consisted of either one or two sessions per week, and centres varied considerably in the length both of the programme and of each session; average number of sessions per patient 9.2 (range 5–16), total session time over a programme 2.32 hours (mean 10.2 hours).

**Table 2. Activity data for 16 cardiac rehabilitation centres in England and Wales, 1993**

Centre	Patients entered in 1993	Drop-out rate (%)	No. diagnostic categories allowed entry	No. assessment techniques used	No. equipment items available	Sessions	
						Per patient	Hours per patient
1	160	25	7	2	1	12	12
2	91	22	7	5	NA	7	4.7
3	293	NA	10	2	4	7	7
4	116	19	2	2	NA	6	7.5
5	375	2	10	2	3	16	16
6	97	19	9	3	NA	10	10
7	150	5	9	3	4	6	4
8	120	NA	6	NA	4	8	12
9	56	7	6	2	4	12	9
10	43	16	8	5	4	8	8
11	140	1	6	3	4	6	2
12	30	NA	7	2	4	8	6
13	280	NA	7	4	4	12	18
14	441	8	6	3	3	8	10
15	185	5	11	NA	NA	16	32
16	573	11	7	4	2	5	5
Mean	196.9	11.6	7.4	3.0	3.4	9.2	10.2
Median	145.0	9.5	7	3.0	4.0	8.0	8.5
SD	155.1	8.2	2.2	1.1	1.0	3.5	7.2

NA = data not available  
SD = standard deviation

Table 3 shows the average number of hours per week spent at the centre by different staff categories and grades. There was an average total of 52 hours of staff input to each centre per week, with wide variation between centres—one providing less than 20 hours and two centres more than 80 hours. Across all centres, 79% of the total was contributed by the nursing grades, 20% by physiotherapists/occupational therapists and 1% by other staff. As Fig 1 indicates, these proportions varied between centres, but in only two centres was the proportion of all hours provided by nursing staff less than 50%.

The main costs of the rehabilitation centres are summarised in Table 4. Their average staffing costs were slightly less than £33,000 and ranged from £10,000 to £62,000; the centre with the highest staffing costs was operating the community based service. Cost per enrolled patient completing the rehabilitation programme averaged £371, but this figure is heavily influenced by the existence of three centres (one of which was the community based service) with particularly high costs (£871, £1,318 and £1,433 per patient respectively). For all centres, the median cost per patient completing the programme was £223. There was little difference in the mean cost per enrolled patient at the seven teaching hospital centres (£349) and the eight DGH centres (£328) participating in the survey. The staffing costs per patient per session averaged £47—again influenced by the three very high cost centres (£124, £165 and £179 per patient per session). The median cost per patient per session was £26. There was no difference between teaching hospital and DGH centres (£42 and £41, respectively).

**Table 3. Average hours per week by staff category**

Staff category	Average hours per week
Nurse grade:	
D	1.2
E	8.3
F	8.5
G	13.7
H	9.4
Physiotherapist:	
senior I grade	5.1
senior II grade	3.5
helper	0.4
Occupational therapist:	
senior I grade	0.7
Pharmacist	0.1
Dietitian	0.1
Secretary	0.9
Tai Chi instructor	0.1
<b>Total (SD)</b>	<b>52 (24.7)</b>

SD = standard deviation

What factors explain these variations in costs? As Table 4 indicates, there is far more variance around the costs per patient than around the total costs per centre, suggesting that the number of patients per centre is the most important source of variation of the former. Figure 2 shows that the correlation between these two variables (which have a lognormal distribution) is strong (Pearson correlation coefficient =

**Fig 1. Proportion of total costs attributable to nursing physiotherapy/occupational therapy and other staff.**

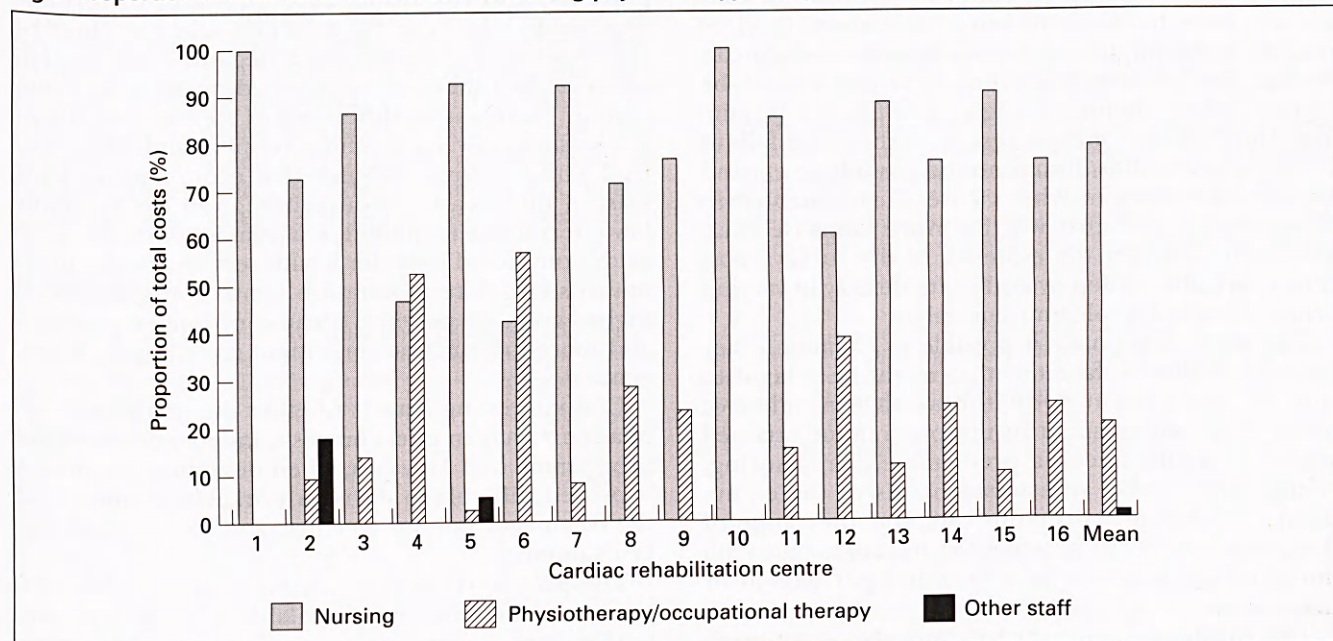


Table 4. Costs of 16 cardiac rehabilitation centres

Centre	Staffing costs (£)		
	Per year	Per patient	Per patient/session
1	10,238	85	7
2	14,516	279	23
3	21,648	230	38
4	22,721	288	29
5	25,920	93	8
6	27,454	75	5
7	30,822	216	36
8	30,944	176	11
9	32,439	233	39
10	33,807	66	13
11	38,663	322	40
12	38,964	96	12
13	39,547	1,318	165
14	45,062	154	22
15	51,598	1,433	179
16	61,854	871	124
Mean (SD)	32,887 (13,214)	371 (436)	47 (56)
Median	31,692	223	26

SD = standard deviation

-0.891) and highly significant ( $p < 0.001$ ). This is an association and may not be a causal relationship, but it suggests that unit costs per patient fall as the number of patients entered into a programme rises: that is, that cardiac rehabilitation programmes experience strong economies of scale. This would accord with the more general picture revealed by the survey, that centres have to incur an initial minimum level of staffing, equipment and accommodation, which can be regarded as essentially fixed costs and have to be met even if the annual throughput of patients is quite low. The unit cost of these resources therefore falls as throughput expands. It may not be possible to expand inputs smoothly, in which case the relationship between size and cost will be more stepwise than linear. However, on the evidence of the survey, most centres are able to deploy staff quite flexibly in varying proportions of a whole-time equivalent.

The survey also made it possible to examine other centre activities or facilities that might be related to the cost per patient. Only the average number of hours each patient spent in the programme attained statistical significance—a predictable, if reassuring, result. The number of assessments used, the equipment available, the drop-out rate and the range of diagnostic conditions accepted on to programmes did not significantly affect the cost either per patient or per session.

The funding of the centres was also examined.

Three of the centres were funded by the British Heart Foundation (BHF) and the remainder by National Health Service (NHS) trusts. On average, the centres admitted similar numbers of patients per annum (BHF 218, NHS 192), but the BHF-supported centres had shorter staff attendance and lower costs both per patient (£161 compared with £419) and per patient per session (£17 compared with £54).

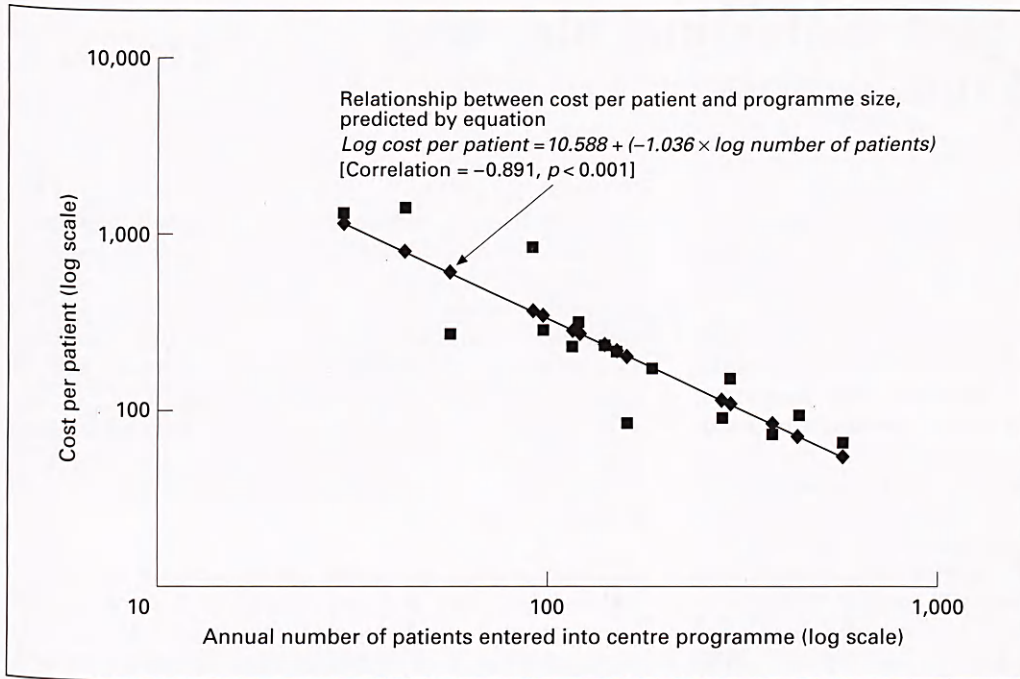
## Discussion

The mean staff cost per patient successfully completing a cardiac rehabilitation programme was £371 at 1994 prices (median £223), and the average cost per patient per session was £47 (median £26). Staff costs included are only those for specifically funded staff, and exclude contributions by extending the roles of staff from other service areas (centres staffed solely by means of role extension were excluded from the study). Even so, these figures are higher than Turner's estimate of a cost per patient completing the programme of £200 [4] and substantially higher (and more varied) than the estimate by Horgan *et al* [2] of a cost per patient per session of £4–15. The results of the present survey indicate a range of £5–179. These differences would be accentuated if non-staff costs were included in the present study. Turner's estimate that staff costs accounted for exactly 80% of the total would involve uprating the costs reported here by approximately 25%.

The cost variation between centres seems primarily to be related to differences in the number of patients using the services and the average hours of contact time of each patient with the rehabilitation programme. For example, staffing in two of the centres exceeded 80 hours per week. One centre enlisted 91 patients, and the other 293, the main difference apparently related to the selection criteria. The first centre selected patients with a negative exercise test, whereas the other centre imposed no such selection criteria. There was no difference in the cost per patient per session between teaching hospital and DGH centres. The tentative evidence that economies of scale exist in this area is encouraging, given the currently low referral rate identified by a number of studies. The study considered only the health service costs; a move towards larger rehabilitation centres might impose higher costs on patients because of longer journeys, and more information on patient costs would be welcome.

One interesting issue is whether the occupancy rate of a centre has an effect on costs, independently of the programme size. However, when designing the survey, it proved difficult to devise a workable definition of the occupancy rate for a centre, and so this could not be examined.

The precise content of cardiac rehabilitation programmes, the equipment available, reasons for variation in drop-out rates, and more complete estimates of



**Fig 2. Relationship between size and unit cost of cardiac rehabilitation programmes**  
 ■ actual observations    ◆ predicted values

staff inputs and non-staff costs are all areas in which further research would be welcome [6,7]. One of the most pressing issues on the health economic research agenda in this area must be the link between the costs of providing these services and their effectiveness in terms of reduced hospitalisation following an acute myocardial infarction or improved survival and quality of life. To date, the only full cost-effectiveness study of cardiac rehabilitation in the USA found no gain in effectiveness [8]. However, the study estimated some cost-effectiveness ratios by making use of the results of an overview [9] to estimate effectiveness, and also empirically estimated quality of life changes to perform a cost-utility analysis. The kind of cost data compiled here, which are potentially more relevant to the patterns of health care delivery in the UK, might allow such issues of cost-effectiveness to be reassessed.

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