

# The Birmingham Rehabilitation Uptake Maximisation Study (BRUM). Home-based compared with hospital-based cardiac rehabilitation in a multi-ethnic population: cost-effectiveness and patient adherence

K Jolly,<sup>1\*</sup> R Taylor,<sup>2</sup> GYH Lip,<sup>3</sup> S Greenfield,<sup>4</sup>  
J Raftery,<sup>5</sup> J Mant,<sup>4</sup> D Lane,<sup>3</sup> M Jones,<sup>4</sup> KW Lee<sup>6</sup>  
and A Stevens<sup>1</sup>

<sup>1</sup> Department of Public Health and Epidemiology, University of Birmingham, UK

<sup>2</sup> Peninsula College of Medicine and Dentistry, Universities of Exeter and Plymouth, UK

<sup>3</sup> University Department of Medicine at City Hospital, Birmingham, UK

<sup>4</sup> Department of Primary Care and General Practice, University of Birmingham, UK

<sup>5</sup> Wessex Institute of Health Research and Development, University of Southampton, UK

<sup>6</sup> University Hospitals of Coventry and Warwickshire, Coventry, UK

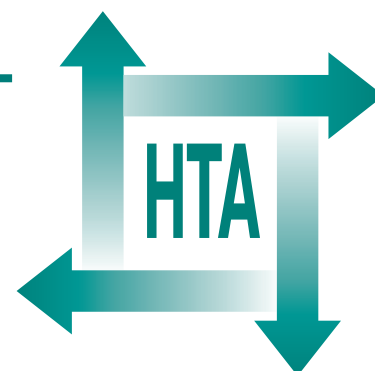
\* Corresponding author



## Executive summary

Health Technology Assessment 2007; Vol. 11: No. 35

Health Technology Assessment  
NHS R&D HTA Programme  
[www.hta.ac.uk](http://www.hta.ac.uk)





## Executive summary

### Objectives

The study aimed to evaluate the relative effectiveness and cost-effectiveness of a home-based programme of cardiac rehabilitation using the Heart Manual, with centre-based programmes in patients who have experienced a myocardial infarction (MI) or coronary revascularisation within the previous 12 weeks. In addition, it sought to explore the reasons for non-adherence to cardiac rehabilitation programmes.

### Methods

#### Design

This was an individually randomised trial, with minimisation for age, gender, ethnicity, initial diagnosis and hospital of recruitment. Participants were followed up after 6, 12 and 24 months by questionnaire and clinical assessment. Individual semistructured interviews were undertaken in the homes of a purposive sample of patients who did not adhere to their allocated programme, and focus groups were undertaken with groups of patients who adhered to the programmes.

#### Setting and patients

Recruitment took place of patients referred to cardiac rehabilitation teams at four hospitals in predominantly inner-city, multi-ethnic, socio-economically deprived areas of the West Midlands, for 2 years from 1 February 2002. Patients were excluded if they were deemed as too high risk for a home-exercise programme, which included patients with unstable angina, clinically significant heart failure, important cardiac arrhythmias or significant lesions remaining post-angioplasty or bypass. Of the 1997 patients presenting with the index events, 1207 (60%) were eligible for the study and 525 (43% of eligible patients) were recruited, with 263 randomised to the home-based arm and 262 to the centre-based arm. Interviews were undertaken with 49 participants who were 'non-adherers' and five focus groups were run for adhering participants.

#### Intervention

All the rehabilitation programmes included exercise, relaxation, education and lifestyle counselling. All patients were seen by a cardiac rehabilitation nurse prior to hospital discharge and

provided with information about their condition and counselling about risk factor modification.

The four centre-based programmes varied in length from nine sessions at weekly intervals of education, relaxation and circuit training to 24 individualised sessions over 12 weeks of mainly walking, fixed cycling and rowing with group-based education.

The home-based programme consisted of a manual, home visits and telephone contact. Patients who had had an MI were discharged home with *The Heart Manual* (second edition). Those who had had a revascularisation received an adapted version of the Heart Manual for this patient group. The Heart Manual was introduced to patients on an individual basis, either in hospital or on a home visit. Home visits by a nurse took place at approximately 1, 6 and 12 weeks after recruitment, with a telephone call at 3 weeks. At the final visit, patients were encouraged to maintain their lifestyle changes and to continue with their exercise programme. Patients who had an insufficient command of English were followed up by a rehabilitation nurse who spoke Punjabi. An audiotape of an abridged version of the Heart Manual in Punjabi accompanied the manual for patients with a limited command of English.

#### Main outcome measures

Primary outcomes were smoking cessation, blood pressure, total and high-density lipoprotein cholesterol, exercise capacity measured by the incremental shuttle walking test and psychological status measured by the Hospital Anxiety and Depression Scale (HADS). Secondary outcomes included self-reported diet, physical activity, cardiac symptoms and quality of life. Health service resource use and costs of rehabilitation programmes from health service and societal perspectives were also measured. Adherence to the physical activity element of the rehabilitation programmes was measured by questionnaire at 6, 9 and 12 weeks.

### Results

At all three follow-up points no clinically or statistically significant differences were found in

any of the primary outcome measures between the home- and centre-based groups or in any of the secondary outcomes.

Significant improvements in total cholesterol, smoking prevalence, the HADS anxiety score, self-reported physical activity and diet were seen in both the home- and centre-based arms between baseline and the 6-month follow-up.

Five or more contacts with a cardiac rehabilitation nurse were received by 96% of participants in the home-based arm, whereas only 56% of participants in the centre-based arm attended this many rehabilitation classes ( $p < 0.001$ ).

The direct rehabilitation costs to the health service were significantly higher for the home-based programme; the mean cost was £198 [95% confidence interval (CI) £189 to £208] versus £157 (95% CI £139 to £175),  $p < 0.05$ , for the centre-based programme. When patient costs were included, the mean cost of the centre-based arm rose to £182 (difference not significant). The programme at Hospital 1 had a significantly higher mean cost than that for Hospital 2 or Hospitals 3 and 4 combined.

Patients' reasons for not taking up or adhering to cardiac rehabilitation were multifactorial and very individual. Other health problems, such as arthritis, and continuing cardiac problems limited some patients' ability to exercise. The majority of non-adherers found some aspects of their cardiac rehabilitation programme helpful. Many had adapted advice on rehabilitation and were continuing to exercise in other ways and had made lifestyle changes, particularly to their diet. On the home-based programme, patients' lack of motivation to exercise on their own at home was a major factor in non-adherence.

The focus groups revealed little diversity of views among patients from each programme. In particular, patients in the hospital programme enjoyed the camaraderie of group exercise and the home-based patients valued the wealth of information and advice in the Heart Manual.

## Conclusions

For low- to moderate-risk patients following MI, percutaneous transluminal coronary angioplasty or

coronary artery bypass graft, a home-based cardiac rehabilitation programme does not produce inferior outcomes compared with the traditional centre-based programmes. With the level of home visiting in this trial, the home-based programme was more costly to the health service, but with the difference in costs borne by patients attending centre-based programmes.

Reasons for non-participation/non-adherence were multifactorial and individualistic, with in most cases one critical factor that determined eventual cardiac rehabilitation behaviour. There were differences in the reasons given by home and hospital cardiac rehabilitation patients, with home-based patients often citing a lack of motivation to exercise at home. Social characteristics, individual patient needs and the location of cardiac rehabilitation programmes need to be taken into account in programme design to maximise participation

## Recommendations for further research

Research is recommended in the following areas:

- cardiac rehabilitation in patients from ethnic minority groups
- development of measurement tools to assess physical activity and dietary change and translated and validated tools in minority languages for these and to measure psychological status
- evaluation of the Heart Manual in patients who decline centre-based cardiac rehabilitation
- evaluation of the implementation of home-based programmes in the UK
- evaluation of strategies that sustain physical activity in the long term.

## Publication

Jolly K, Taylor R, Lip GYH, Greenfield S, Raftery J, Mant J, *et al.* The Birmingham Rehabilitation Uptake Maximisation Study (BRUM). Home-based compared with hospital-based cardiac rehabilitation in a multi-ethnic population: cost-effectiveness and patient adherence. *Health Technol Assess* 2007;**11**(35).

# NIHR Health Technology Assessment Programme

The Health Technology Assessment (HTA) programme, now part of the National Institute for Health Research (NIHR), was set up in 1993. It produces high-quality research information on the costs, effectiveness and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care, rather than settings of care.

The research findings from the HTA Programme directly influence decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC). HTA findings also help to improve the quality of clinical practice in the NHS indirectly in that they form a key component of the 'National Knowledge Service'.

The HTA Programme is needs-led in that it fills gaps in the evidence needed by the NHS. There are three routes to the start of projects.

First is the commissioned route. Suggestions for research are actively sought from people working in the NHS, the public and consumer groups and professional bodies such as royal colleges and NHS trusts. These suggestions are carefully prioritised by panels of independent experts (including NHS service users). The HTA Programme then commissions the research by competitive tender.

Secondly, the HTA Programme provides grants for clinical trials for researchers who identify research questions. These are assessed for importance to patients and the NHS, and scientific rigour.

Thirdly, through its Technology Assessment Report (TAR) call-off contract, the HTA Programme commissions bespoke reports, principally for NICE, but also for other policy-makers. TARs bring together evidence on the value of specific technologies.

Some HTA research projects, including TARs, may take only months, others need several years. They can cost from as little as £40,000 to over £1 million, and may involve synthesising existing evidence, undertaking a trial, or other research collecting new data to answer a research problem.

The final reports from HTA projects are peer-reviewed by a number of independent expert referees before publication in the widely read monograph series *Health Technology Assessment*.

## Criteria for inclusion in the HTA monograph series

Reports are published in the HTA monograph series if (1) they have resulted from work for the HTA Programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reported in this monograph was commissioned by the HTA Programme as project number 99/32/09. The contractual start date was in October 2001. The draft report began editorial review in March 2006 and was accepted for publication in November 2006. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

The views expressed in this publication are those of the authors and not necessarily those of the HTA Programme or the Department of Health.

Editor-in-Chief:

Professor Tom Walley

Series Editors:

Dr Aileen Clarke, Dr Peter Davidson, Dr Chris Hyde,  
Dr John Powell, Dr Rob Riemsma and Professor Ken Stein

Programme Managers:

Sarah Llewellyn Lloyd, Stephen Lemon, Stephanie Russell  
and Pauline Swinburne

ISSN 1366-5278

© Queen's Printer and Controller of HMSO 2007

This monograph may be freely reproduced for the purposes of private research and study and may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising.

Applications for commercial reproduction should be addressed to: NCCHTA, Mailpoint 728, Boldrewood, University of Southampton, Southampton, SO16 7PX, UK.

Published by Gray Publishing, Tunbridge Wells, Kent, on behalf of NCCHTA.

Printed on acid-free paper in the UK by St Edmundsbury Press Ltd, Bury St Edmunds, Suffolk.