



# Does the mode of delivery in Cardiac Rehabilitation determine the extent of psychosocial health outcomes?

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## ABSTRACT

**Background:** Cardiac Rehabilitation (CR) is a multicomponent tailored intervention aiming to reduce lifestyle risk factors and promote health in patients post cardiovascular disease. CR is delivered either as supervised or facilitated self-delivered yet little evidence exists evaluating the association between mode of delivery and outcomes. **Methods:** This observational study used data routinely collected from the National Audit of Cardiac Rehabilitation from April 2012–March 2016. The analysis compared the populations receiving supervised and facilitated self-delivered modes for differences in baseline demographics, four psychosocial health measures pre and post CR and changes in anxiety, depression and quality of life following the intervention. The analysis also modelled the relationship between mode and outcomes, accounting for covariates such as age, gender, duration and staffing.

**Results:** The study contained 120,927 patients (age 65, 26.5 female) with 82.2% supervised and 17.8% self-delivered. The analysis showed greater proportion of females, employed and older patients in the self-delivered group. Following CR, patients in both groups demonstrated positive changes which were of comparable size. The regression model showed no significant association between mode of delivery and outcome in all four psychosocial outcomes when accounting for covariates ( $p$ -value > 0.05).

**Conclusions:** Patients benefited from attending both modes of CR showing improved psychosocial health outcomes with 3–76% change from baseline. Over half of CR programmes in the UK do not provide self-delivered CR yet this mode is known to reach older patients, female and employed patients. Facilitated self-delivered CR should be offered and supported as a genuine option, alongside supervised CR, by clinical teams.

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## 1. Introduction

Cardiac Rehabilitation (CR) is a strongly evidenced intervention that is recognised as integral to comprehensive care for a range of cardiac conditions and treatments [1–3]. CR had, in 2007, a class one recommendation from the American Heart Association, American College of Cardiology and the European Society of Cardiology in the care of patients with heart disease [1,4].

The evidence for CR can be split into trial evidence and modern observational clinical registries [1–2]. The trial data, for the effectiveness of CR, summarised by the most recent Cochrane review shows that CR reduces cardiovascular mortality (RR 0.74, 95% CI 0.64–0.86) and hospital re-admissions post CR (RR 0.82, 95% CI 0.70–0.96) [1]. The registry data shows that CR could also significantly reduce all-cause mortality

(HR 0.37, 95% CI 0.20–0.69) [3]. This disparity in conclusions highlights the differing populations that the studies/trials incorporate. In that Cochrane review average patient age was 56 years, whereas in the 2016 National Audit of Cardiac Rehabilitation (NACR) patients in the UK were shown to be 65 years, a 9 year increase in average age [1,5]. This issue of representativeness is a justification for increased use of observational registry based research.

Currently, the UK is world leading with 50% uptake across the four main diagnosis/treatment groups, Myocardial Infarction (MI), Percutaneous Coronary Intervention (PCI), MI + PCI, and Coronary Bypass Graft (CABG) [5]. Modern CR remains dominated by group-based approaches, with 82% of all patients taking up this mode of delivery as evidenced through the NACR 2016 report [5]. In 2017 a review concluded, based on 23 trials, that home based versus centre based rehabilitation was not associated with patients' outcomes, including physical capacity, mortality and health related quality of life. This strongly supports the utilisation of a diverse menu based approach to CR, which would include group based, home based and manual based CR [6]. However, in 2016 only ~60% of programmes in the UK did not have patients

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<sup>1</sup> This author takes responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

receiving home-based in the 2016 audit [5]. Additionally, as shown in the review of CR effectiveness, evidence based on trial populations is often not representative of routine care. In the home vs. centre review 6 trials contained no female participants, when routine care shows around 30% female participation [1,6].

The traditional mode of CR delivery in Europe is supervised CR, with a median of 12 months with exercise as a predominant factor [1–2,5,7–8]. Alternatively, facilitated self-delivered structured programmes such as the Heart Manual, Angina plan and home-based CR exist which are completed over a similar period [5–8]. The two forms of delivery, supervised versus facilitated self-delivered CR, are now forming modern CR. There is debate whether supervised delivery is better than its structured self-delivered counterpart containing facilitation from the CR team, as described in the heart manual [8]. A Danish study, from the CopenHeart research group, allocated patients into supervised group-based or self-care home-based; the findings were similar to that of the Cochrane Review and trial in favour of equivalence [9].

The British Association for Cardiovascular Prevention and Rehabilitation (BACPR) core components state that CR can be delivered in a variety of ways such as centre based and home-based along with the trial evidence that exists to suggest a comparable association with outcomes [10]. This study aims to investigate whether in a routine care population there is an association between patients receiving supervised or self-delivered CR and their psychosocial health outcomes post-CR. This will build upon the trial evidence, but in a more representative and diverse population.

## 2. Methods

This study was reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [11].

### 2.1. Data

The planned analyses used routinely collected patient-level data from the UK NACR database from 1st April 2012 to 31st March 2016. NACR collects electronic patient-level data from over 226 programmes each year [5].

NACR collects information about patients going through CR such as initiating event, treatment type, individual risk factors, medication use, patient characteristics and outcomes, along with centre level information; volume and staffing profiles [5]. Data is collected under NHS data requirements, reviewed annually by NHS Digital, which hosts and oversees the quality of audit data in the NHS. All data used in this study is anonymised by NHS Digital before reaching the NACR team.

CR is recommended for patients with a diagnosis of MI, heart failure, and angina; along with being eligible after having a treatment of CABG, PCI and Pacemaker [12–14]. All patients entered into the audit, within the time period, with an in scope diagnosis or treatment were included in the analysis [5].

The study includes CR programmes in the UK, with valid patient data at both pre and post CR assessment and completed data fields capturing staffing information. Inclusion was based on all patients with a valid diagnosis/treatment, started CR and a mode of delivery completed; this population was verified against the whole CR population without these measures completed (matching age, gender and baseline scores).

### 2.2. CR/Mode of delivery

Nationally CR is expected to be conducted according to the BACPR core components, which recommends a patient-tailored approach, based on the baseline assessment, defined needs and patient preference [10]. Patient specific CR means that mode of delivery is a patient-level variable, whereas staffing type is programme level.

For this study mode of delivery was coded from NACR variables, including group-based, home-based and web-based, into supervised (with staff present) and facilitated self-delivered (with contact but no staff required for the exercise component). Patients recorded as receiving delivery classified as 'other' were excluded from the study due to lack of descriptive information; this equalled 3% of patients, and were assessed for differences in demographics to ensure our final sample was representative.

### 2.3. Outcome measures

Psychosocial health status is a core area for CR, which in the UK includes assessment of the extent of anxiety, depression, self-perceived feelings and Quality of Life (QoL) at baseline and following CR as a measure of outcome improvement. Before starting, the 8–12 week CR programme all patients should receive a baseline assessment, which includes the Hospital Anxiety and Depression Scale (HADS) and Dartmouth questionnaire. This records their psychosocial well-being at baseline, which helps tailor the intervention. The patient is then

provided a follow-up assessment post CR that assesses their improvement across the intervention. The outcomes included were HADS for anxiety and depression and the Dartmouth questions for Quality of Life (QoL) and feelings. HADS Anxiety and depression symptoms were separately measured (score range 0–21) with higher scores representing worse symptoms; patients were grouped by score as normal category ( $\leq 8$ ) and at-risk group ( $8+$ ) [15–16]. The Dartmouth feelings and QoL questions provide self-perceived psychosocial health scores. Responses were coded 1–5 and were dichotomised (normal score 1–3, at-risk score 4–5) [11].

### 2.4. Statistical analysis

The analyses were conducted in STATA 13.1. Baseline characteristics were compared across groups using Chi<sup>2</sup> and odds ratios for categorical variables or *t*-test for continuous variables. Regression models were built to investigate whether, accounting for covariates, the supervised and self-delivered methods for mode of delivery were associated with outcomes post CR.

Relevant important covariates were included in the analysis, where they were evidenced in the literature or significant in preliminary analysis. Age (years), gender (male/female), number of comorbidities and employment status have been shown to influence the outcomes following a variety of different interventions, including CR [16–18]. Employment status was coded as employed/retired or unemployed, this is because previous research found that employed and retired states have similar effects on outcomes [16]. The duration of CR (length of CR) was also included in the analysis along with staffing profile, total staff hours, Multi-Disciplinary Team (MDT) and total centre volume. The staffing information comes from the annual survey, performed routinely by the NACR to gain centre level information such as staff profile, hours and funding type. Because the mode of delivery was a patient-level variable, it was important to take into account the relative size and staffing profile of the centre where the patient received the CR.

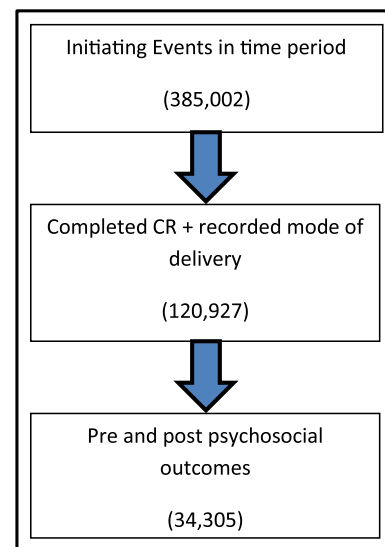
Hierarchical logistic regressions were used to investigate the association between mode of delivery, as an independent variable, and psychosocial health outcomes as the dependent variable. A hierarchical design was used to account for different levels of patient and centre level data. Statistical level for significance was  $p < 0.05$ . Data model checking was performed to ensure that the models were a good fit through assumptions associated with the regressions.

## 3. Results

### 3.1. Study population

The study included 120,927 valid cases from across the UK that attended CR in the four-year period, this was from a sample of 385,002 patients entered in the time period, shown in Fig. 1. Within our eligible population, 82.3% received supervised CR whereas 17.7% received CR such as home-based or web-based coded as self-delivered.

The analysis in Table 1 shows increased odds for females and employed patients receiving self-delivered CR (1.26 and 1.24). The analysis also showed that older patients, lower mean comorbidity and longer



**Fig. 1.** Flow diagram showing total population in time period, those with valid mode of delivery and those with pre and post outcome measures resulting in them being included in regression analysis

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