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Barriers and facilitators to participating in cardiac rehabilitation and physical activity in a remote and rural population; a cross-sectional survey

Running title: Cardiac rehab and physical activity associations

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Abstract

Background: Cardiac disease requires ongoing active management which may include attendance at formal cardiac rehabilitation (CR) and increased physical activity (PA). However, uptake rates are sub-optimal. This study aimed to identify factors associated with attendance at CR and PA in a rural Scottish population.

Methods: A cross-sectional postal survey assessing factors potentially associated with attending CR and participating in PA. Data were also collected from hospital electronic medical records. Binary logistic and ordinal regressions were used to identify barriers and facilitators to participation.

Results: The cohort consisted of 840 participants referred to the CR department of a regional Scottish hospital. After applying the inclusion/exclusion criteria, 567 patients were sent a questionnaire. The number of returned questionnaires was 295 (52.0%). Responders were predominantly male (75.9%), with a mean age of 68.7 years. At the multivariate level, the only factor associated with CR attendance was a lack of perceived need (odds ratio [OR] 0.02, 95% confidence interval [CI] 0.01–0.06). Analyses of PA associations identified self-efficacy as the only significant facilitator (OR 1.29, 95% CI 1.05–1.59), and a lack of willpower as the only barrier (OR 0.42, 95% CI 0.18–0.97). Other factors were linked to CR attendance and PA at a univariate level only.

Conclusions: This study characterised CR and PA participation, and explored demographic, medical, and psychological factors associated with both activities — with the most important being perceived need, self-efficacy and willpower. These findings may be beneficial in clinical practice by targeting these factors to increase CR attendance and PA levels.

Key words: cardiac rehabilitation, physical activity, barriers, facilitators, rural

Introduction

Heart disease is a leading cause of mortality worldwide [1]. Cardiac rehabilitation (CR) aims to reduce morbidity and mortality from heart disease by targeting modifiable risk factors, such as obesity, smoking and lack of exercise [2]. The most important element of CR, in terms of reducing cardiovascular mortality, hospital admissions, and increasing health-related quality of life, is exercise (or physical activity [PA]) [3].

It is recommended that all adults should achieve a weekly minimum of 150 min of moderate-intensity PA, or 75 min of vigorous-intensity PA, in bouts of 10 min or more [4]. Despite the proven benefits and endorsement in national guidelines, in 2012 it was shown that 47% of adult women and 37% of adult men in Scotland were not achieving these recommendations [5]. In addition, CR uptake remains suboptimal, with only 51% of eligible patients attending in England, Wales and Northern Ireland [6].

Factors associated with poor CR attendance include: age, gender, lack of knowledge, cost, lack of transport, self-efficacy, motivation, and social support [7, 8]. Distance from classes may be particularly important in remote rural populations [9, 10]. Factors associated with lower PA (distinct from CR attendance) include: poor health, lack of time, knowledge or access to facilities, costs, gender, motivation and self-efficacy, to name a few [11]. These factors remain relatively understudied in rural areas and the paucity of evidence in such populations may have particular implications for Scotland, where over 20% of the country is classed as remote or rural [6, 12].

This study aimed to explore factors influencing participation in CR and PA after a cardiac event in a remote and rural Scottish population to identify potential targets for future interventions to improve participation rates.

Methods

Design

The study employed a cross-sectional survey design.

Participants

Consecutive patients referred for standard CR classes at a regional hospital in the North of Scotland from May 2016 to May 2017 were included, the catchment area of this hospital being over 30,000 km^2 and including several CR sites. Patients were referred to CR following an acute coronary syndrome (myocardial infarction or unstable angina), angina, heart failure, post-cardiac surgery (valves, transplantation or coronary artery bypass grafting [CABG]), percutaneous coronary intervention (PCI), cardiac device implantation, adult congenital heart disease, out-of-hospital cardiac arrest, or a step-change in their cardiac condition. Exclusion criteria were: previous referrals of the same patient, not resident in catchment area, aged less than 18, non-cardiac or unclear diagnosis, or if CR, PA or questionnaire completion was deemed inappropriate for the specific patient (e.g. frailty, life-limiting or distressing illness, severe dementia or other severe psychiatric condition). The latest referral of the participant was used if the patient had been invited to CR on more than one occasion.

Instruments

The survey contained 4 sections, which combined several questionnaires, and respectively collected data regarding: demographics; quality of life; CR; and PA. All individual questionnaires have previously been validated and demonstrate adequate psychometric properties.

The demographic section included questions about age, gender, working status and occupation, smoking status, education, home occupants, feelings of loneliness, and transport access.

Quality of life was assessed using the European Quality of Life 5 Dimensions (EQ-5D-5L) instrument and the European Quality of Life Visual Analogue Scale (EQ-VAS), with permission for use being obtained [13, 14]. A single index value of health state (0 being low, to 1 being higher) was generated from the EQ-5D-5L, using the Devlin et al. [14] value set. The EQ-VAS asks participants to rate their overall health out of 100 (0 being “the worst health imaginable”, and 100 being “the best”).

Cardiac rehabilitation experience was assessed by initially asking 3 questions: were they invited to CR; did they attend all, some or none of the classes; and whether they had ever previously attended CR. Barriers and facilitators to attending CR were assessed using the Cardiac

Rehabilitation Barriers Scale (©CRBS, permission for use obtained) [15]. The ©CRBS (©CRBS: Shanmugasegaram S, Gagliese L, Oh P, Stewart DE, Brister SJ, Chan V, Grace SL. Psychometric validation of the cardiac rehabilitation barriers scale. Clin Rehabil. 2012; 26(2): 152–164) comprises 21 items and uses a 5-point Likert scale instrument (strongly disagree to strongly agree) to assess potential barriers in 4 key areas: perceived need/health care factors (e.g. "I don't need cardiac rehab", "my doctor did not feel it was necessary"); logistical factors (e.g. distance, cost); work/time conflicts, and co-morbidities/functional status (e.g. "I am too old", "I don't have the energy") [15].

Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ) short version [16]. Participants were grouped into low, moderate or high PA levels based on the IPAQ group scoring guideline [17]. Barriers to PA were assessed by the Barriers to Being Active Quiz, which comprises 21 statements, measuring barriers over 7 areas: social influences, fear of injury, and lack of; skill, energy, willpower, time, and resources [18]. The scoring of this questionnaire produces a binary predictor — barrier present or absent.

Social support was assessed with the Social Support and Exercise Survey [19]. Participants rated how often family and friends participated in certain activities regarding PA, with higher scores indicating more social support for exercise. PA self-efficacy was measured using a 12-item instrument, asking participants to rate their confidence in their ability to be active in various circumstances [20]. The items were then scored into 3 themes, self-efficacy for: overcoming barriers to being active, completing the activity itself, and scheduling time to be active. A higher score indicates higher PA self-efficacy in that subscale. Motivation for PA was assessed using the intrinsic, extrinsic and amotivation subscales from the Behavioural Regulation in Exercise Questionnaire [21, 22].

Procedures

The cohort was screened using electronic hospital medical records and participants identified who satisfied the inclusion/exclusion criteria. A subject specialist (cardiologist) adjudicated any uncertainties regarding patient inclusion. Identified participants were then sent a study pack containing a personalised cover letter, patient information sheet, consent form, the questionnaire, and a stamped addressed return envelope. A reminder pack was sent after 2–3 weeks to non-responders, with data collection being terminated after 6 weeks. Ethical approval was obtained from the Bromley Research Ethics Committee (study reference number 17/LO/1389, project number 231385).

The diagnosis, management, and co-morbidity data reported at the time of the index event was collected from electronic hospital medical records. Participant postcodes were used to assess rurality and socioeconomic status using the Scottish Government 6-fold Urban Rural Classification 2013/14, and the Scottish Index of Multiple Deprivation (SIMD) 2016 quintiles, respectively [12, 23].

Statistical analysis

All data were anonymised, then entered and analysed using SPSS (version 24, IBM Corp., Armonk, NY, USA). The analysis was conducted in two stages. In step one, each independent variable was examined in a univariate analysis using a variety of descriptive statistics, χ^2, independent *t*-tests, and ANOVA approaches to explore group differences.

In step two, all factors associated with the outcome (CR attendance or PA level) at the 10% significance level were included within a multivariate analysis using binary and ordinal logistic regressions. Binary logistic regression was used to identify factors associated with attending CR (attended all classes vs no classes). Participants who reported attending “some” classes (n = 49, 17.3%) were excluded as it was not possible to distinguish the degree of attendance and therefore their responses could have confounded the results. A similar approach was employed to identify associations with PA, however, ordinal logistic regression was used, due to the presence of three groups.

Results

Study cohort

The initial cohort was composed of 840 individuals referred to CR. After applying inclusion/exclusion criteria, 567 individuals were invited to participate. This process, and participant exclusion rationale, is summarised in Figure 1.

Sample characteristics

Of the 567 patients, 295 (52%) returned a questionnaire. The mean age of responders was 68.7 ± 10.5 years (range 33–90), with 224 (75.9%) men. Compared to non-responders, responders were older (non-responders mean age 65.0 vs. responders 68.7, $p < 0.001$), had a higher proportion of men (75.9% in responders vs. 66.9% non-responders, $p = 0.022$) and tended to be from more affluent areas ($p = 0.001$). There were no significant differences between responders and non-responders in terms of rurality, diagnosis, management, or co-morbid status.

Barriers to attending cardiac rehabilitation

Table 1 compares the characteristics of responders who attended (n = 101) and did not attend (n = 133) CR, and displays the multivariate analysis. Attenders were less likely to be smokers ($p = 0.023$), were from more affluent areas ($p = 0.041$), from less rural areas ($p = 0.026$), and have fewer morbidities on average ($p = 0.031$). Attenders scored lower than non-attenders on all barrier's subscales ($p < 0.001$).

Factors with univariate significance at the 10% level ($p \leq 0.1$) were entered into the final multivariate model. The model was significant ($p < 0.001$; Nagelkerke $R^2 = 0.690$). Lack of perceived need for CR was the only significant factor, and was associated with a 50-fold reduction in attendance (odds ratio [OR] 0.02, 95% confidence interval [CI] 0.01–0.06, $p < 0.001$).

Barriers to physical activity

Table 2 compares the characteristics of participants when grouped by PA levels according to the IPAQ, and shows the multivariate analysis. Compared to low active participants, higher active patients were more likely to be younger ($p = 0.008$), non-smokers ($p = 0.015$), in employment ($p = 0.033$), living with a spouse or partner ($p = 0.03$), less lonely ($p = 0.049$) and had access to a bicycle ($p = 0.006$). They were also more likely to report higher quality of life ($p < 0.001$) and have less co-morbidities on average ($p < 0.001$). Higher active patients also reported higher social support from family and friends, self-efficacy and intrinsic motivation to be active. Conversely, increased co-morbidity, lack of positive social influence, lack of will power, and lack of skill were associated with lower levels of activity. CR attendance for the index event was also associated with higher levels of PA ($p = 0.009$).

Factors with univariate significance at the 10% level were entered into a multivariate model, which was significant ($p = 0.001$, test of parallel lines $p = 0.074$; the Pearson χ^2 statistic goodness-of-fit $p = 0.236$, Nagelkerke $R^2 = 0.316$). Two significant predictors of PA emerged: self-efficacy for overcoming barriers to being active (OR 1.29, 95% CI 1.05–1.59, $p = 0.016$), which was associated with higher activity levels (a facilitator); and lack of willpower (OR 0.42, 95% CI 0.18–0.97, $p = 0.043$), which was associated with lower levels of activity (a barrier).

Discussion

This study demonstrated that perceived need for CR, and self-efficacy for overcoming barriers and willpower for PA were significant predictors of participation. These are important findings, suggesting factors that could be targeted with interventions in clinical practice to address low participation in cardiac patients.

Cardiac rehabilitation

Cardiac rehabilitation participation rate in this population was found to be 53.0%, with a completion rate of 67.3%. This is broadly consistent with United Kingdom (UK) national averages (51% and 77% respectively in 2017 [6]). Within this UK audit [6], differences in attendance were reported by diagnostic and management subgroups, such as increased uptake in PCI and CABG patients, however, no such differences were identified in this study. This may be due to differences in diagnostic and management definitions, sample differences (e.g., the audit sample was much larger), or modes of CR delivery examined (only traditional exercise class CR was investigated in this study).

Perceived need was identified as the single most important factor associated with CR non-attendance. This finding is consistent with previous studies citing perceived need, or the items used to score this subscale, as significant barriers [10, 24, 25]. Perceived need consists of patient and healthcare provider factors. The healthcare factors include: lengthy referral processes, no contact from the department, not knowing about CR, and the perception that their doctor did not think CR was necessary [15]. These healthcare factors provide potential targets for service improvement, and enhancing these aspects of the programme may exert a positive effect on patient understanding of CR necessity, and therefore increase attendance. For example, previous research has suggested that the "strength of referral" (how strongly physicians advocate CR) among other physician-related factors are key in uptake, and may prove a vital intervention target for the service [26, 27]. Personal factors associated with perceived need (e.g. "I don't need rehab") could also be targeted through patient education and advice to improve these perceptions.

Distance from classes has been identified as an important barrier in rural populations [9, 10]. However, in the current study, neither rurality or the logistics barriers subscale (which includes distance, cost and access to transport) showed significant associations with CR attendance in the fully adjusted model. However, these factors were significant at the univariate level and may merit future research. Study findings may vary due to differences in the geography of Australia and Canada compared to Scotland (degree of rurality), or because there are several CR class sites dispersed across the area considered in this study. This is to ensure the remote rural areas are provided a service, therefore meaning that although the patient's address is considered rural, a CR site may be relatively near to them and distance may not be a barrier to attendance.

Physical activity

Within the current study, 22.5% were classed as low active, 29.8% as moderately active, and 47.7% as high active. The most important factors associated with PA levels were self-efficacy to overcome barriers to being active and lack of willpower. The positive association between self-efficacy and PA has been extensively reported [28–30]. Although not linked to CR attendance in this study, CR does provide a potential opportunity for patients to develop strategies to overcome barriers to being active, which may support this behaviour in the future. For example, a previous randomised controlled trial compared group-mediated cognitive behavioural interventions (which incorporated training on how to identify and overcome barriers to being active to encourage self-regulation), with a traditional exercise-based CR programme [31]. This study found that those in the cognitive behavioural intervention group showed a greater increase in fitness, and better adherence to an active lifestyle in the long-term, compared with traditional CR. The intervention group also had a greater increase in self-efficacy at post-intervention [31].

Therefore, including such targeted behaviour training to increase self-efficacy and assist patients to identify and overcome barriers to being active, may prove invaluable in CR. In addition to this, other techniques have been shown to increase both self-efficacy and PA, including: action planning, reinforcing efforts towards the desired behaviour, and providing instruction, all of which could be implemented within CR [32]. Furthermore, national guidelines recommend that psychoeducation and techniques such as goal setting, action planning, and self-monitoring to improve self-efficacy should be considered in CR to improve adherence to the programme, and long-term maintenance of PA [2].

Willpower has previously been identified as a barrier to behaviour change. Lack of willpower was the most commonly reported reason for not adopting desired habits (such as increasing PA) in a study exploring health behaviours in a sample of obese Canadian participants [33]. A lack of willpower was also a more common barrier to behaviour change than work or family responsibilities [34]. Willpower itself has several synonyms and definitions but can be thought of as one’s ability to consciously self-regulate behaviour (or self-control). Previous work has suggested that a key component to behaviour change is “perceived behavioural control”, which is defined as “the perceived ease or difficulty of performing the behaviour” relating to beliefs about factors that may impact one’s ability to perform the desired behaviour [35]. These factors may be internal (e.g. one’s willpower) or external (e.g. money required to use facilities to be active). It has been suggested that self-efficacy may contribute to perceived behavioural control, and so the methods above to target self-efficacy, may also be useful in addressing willpower [35].

An association between CR attendance and future activity levels was not demonstrated in this study. This contrasts with the UK CR audit [6], but is consistent with some other studies [36]. One possible explanation for these contrasting results is that high baseline activity levels before CR may cause some programmes to appear less effective if a higher proportion of patients were active at baseline [6]. Therefore, the benefits may not be apparent at a single site comparison, such as in this study. Furthermore, baseline activity levels in this study are unknown.

This study has several strengths: the respondents were largely representative of the target patient cohort, achieved a 52% response rate, and the study focused on a remote and rural Scottish population — a group which has been broadly neglected in previous research. However, the use of hospital letters to establish co-morbidity may have led to an underestimation of co-morbidity burden, although this was a consistent approach so no bias would result between patient groups. The self-reported information is subject to both reporter and recall bias.

Future research could aim to address these identified barriers and enhance facilitators. This could involve some of the targeted interventions previously mentioned to improve perceived need, willpower and self-efficacy to overcome barriers to being active in cardiac patients. The effect of any interventions on these factors could be monitored over time and the change in numbers of patients participating in CR and PA examined with longer follow-up.

Conclusions

The most important factor identified for CR attendance was lack of perceived need, and for PA the most important factors were self-efficacy to overcome barriers and lack of willpower. The identified factors could potentially be targeted in clinical practice to identify at-risk patients, and strategies implemented to overcome these associations to encourage CR and PA participation in these individuals.

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Conflict of interest: None declared

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Figure 1. Displaying the process of participant exclusion.

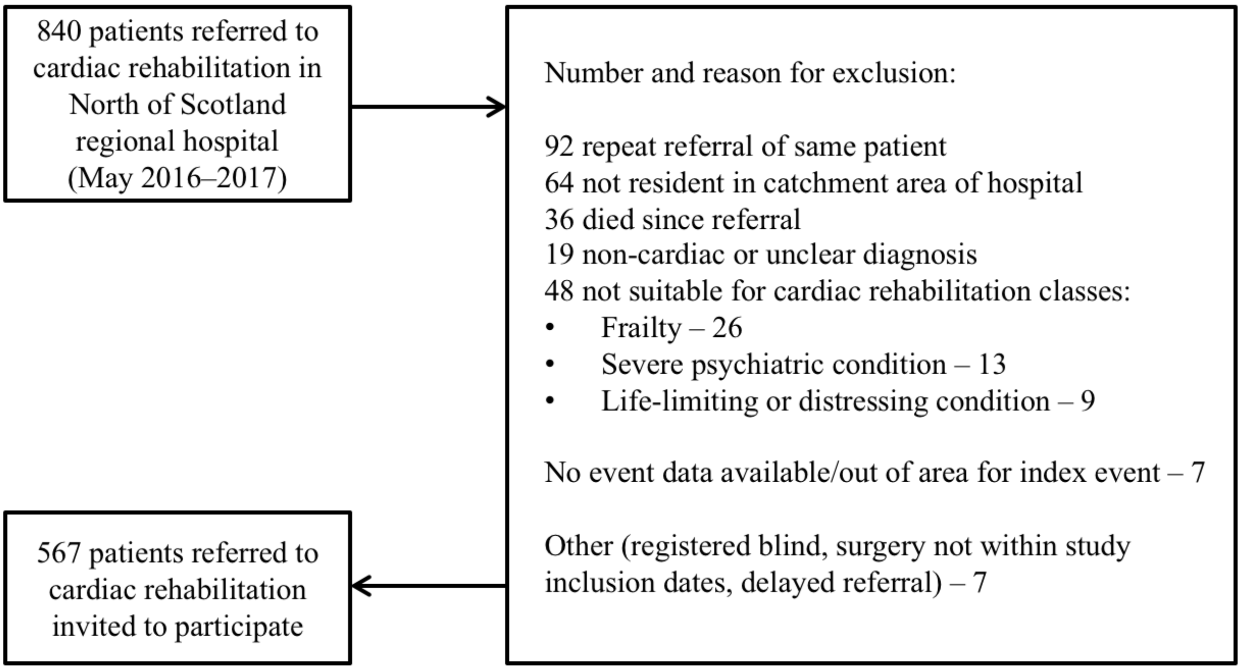

Table 1. Characteristics of attenders compared with non-attenders and factors associated with attendance.

	Non-attender (n = 133)	**Attender (n = 101)**	**P**	**+Multivariate OR (95% CI)**	**P**
Age, range; n=234	68.9 ± 11.5, 33–90	68.6 ± 9.8, 37–86	0.793	–	–
Men; n = 234	99 (74.4%)	79 (78.2%)	0.605	–	–
Scottish index of multiple deprivation score quintile; n = 232:					
1 or 2 (most deprived)	28 (21.1%)	12 (12.1%)	0.041	1.00	
3	47 (35.3%)	28 (28.3%)		1.51 (0.37–6.09)	0.566
4 or 5 (least deprived)	58 (43.6%)	59 (59.6%)		2.89 (0.82–10.25)	0.100
Scottish urban rural 6-fold classification; n = 230:					
Other urban area	24 (18.3%)	35 (35.4%)	0.026	1.00	
Remote small town	29 (22.1%)	16 (16.2%)		0.72 (0.19–2.75)	0.628
Accessible rural	14 (10.7%)	6 (6.1%)		0.25 (0.05–1.39)	0.113
Remote rural	64 (48.9%)	42 (42.4%)		0.63 (0.20–1.99)	0.428
Working (full or part-time); n = 228	43 (32.8%)	28 (28.9%)	0.622	–	–
Feelings of loneliness (sometimes or often); n = 229	50 (37.9%)	41 (42.3%)	0.593	–	–
Home occupants; n = 230:					
Alone	32 (24.2%)	18 (18.4%)	0.108	–	–
Spouse/partner	91 (68.9%)	78 (79.6%)		–	–
Other (family/friends/pets)	9 (6.8%)	2 (2.0%)		–	–
Smoking; n = 231:					
Never	50 (37.9%)	42 (42.4%)	0.023	^	^
Ex-smoker	62 (47.0%)	53 (53.5%)		^	^
Smoker	20 (15.2%)	4 (4.0%)		^	^
Highest level of education; n = 229:					
School	67 (51.1%)	36 (36.7%)	0.094	1.00	
College	37 (28.2%)	35 (35.7%)		0.80 (0.28–2.32)	0.686
University	27 (20.6%)	27 (27.6%)		1.42 (0.42–4.81)	0.575
Diagnosis; n = 234:					
Non-ST elevation MI	41 (30.8%)	36 (35.6%)	0.714	–	–
ST elevation MI	35 (26.3%)	19 (18.8%)		–	–
Unstable angina	12 (9.0%)	11 (10.9%)		–	–
Stable angina	26 (19.5%)	19 (18.8%)		–	–
Other (HF, arrhythmia or structural cardiac disease)	19 (14.3%)	16 (15.8%)		–	–
Management; n = 234:					
Medical	25 (18.8%)	16 (15.8%)	0.291	–	–
Percutaneous coronary intervention	89 (66.9%)	63 (62.4%)		–	–
Surgical	18 (13.5%)	18 (17.8%)		–	–
Cardiac device	1 (0.8%)	4 (4.0%)		–	–
Co-morbidities; n = 234:					
Number of co-morbidities, range	2.8 ± 2.1, 0–13	2.3 ± 1.6, 0–8	0.031	0.77 (0.57–1.06)	0.106
Previous attendance at cardiac rehabilitation before index event; n = 232	11 (8.3%)	13 (13.0%)	0.348	–	–
Barriers subscales; n = 204					
Perceived need/healthcare factors	2.66 ± 0.62	1.49 ± 0.49	< 0.001	**0.02 (0.01–0.06)**	**< 0.001**
Logistic factors	2.36 ± 0.91	1.64 ± 0.77	< 0.001	1.79 (0.80–3.98)	0.155
Work/time conflicts	2.22 ± 0.90	1.75 ± 0.87	< 0.001	1.68 (0.86–3.29)	0.128
Co-morbidities/functional status	2.33 ± 0.99	1.54 ± 0.64	< 0.001	0.74 (0.39–1.39)	0.345
Total ©CRBS barriers; n = 205	2.47 ± 0.58	1.57 ± 0.55	< 0.001	–	–

Chi-square and independent *t*-tests used to analyse categorical and continuous data, respectively; n (percent)/mean ± standard deviation (SD) of complete data detailed for each variable row

MANOVA of barriers subscales (not including total barriers); attenders (n = 89) compared with non-attenders (n = 115), Wilks' Lambda = 0.472, [F (4,199) = 55.588], p < 0.001

+Multivariate regression analysis based on complete data for 198 responders (113 non-attenders; 85 attenders). Univariate significance taken at 10% level ($p \leq 0.1$), excludes total barriers due to correlation with individual barrier scales. Nagelkerke R^2 of adjusted model = 0.690, p < 0.001.

^Sample size of current smokers too small to enter into multivariate analysis

©CRBS: Shanmugasegaram S, Gagliese L, Oh P, Stewart DE, Brister SJ, Chan V, Grace SL. Psychometric validation of the cardiac rehabilitation barriers scale. Clin Rehabil. 2012; 26(2): 152–164.

CI — confidence interval; MI — myocardial infarction

Table 2. Characteristics of participant activity groups and factors associated with being active

	Low active (n = 64)	Moderately active (n = 85)	High active (n = 136)	P	+Multivariate OR (95% CI)	P
Age (mean ± SD), range; n = 285	72.1 ± 11.2, 41–87	68.3 ± 9.0, 47–85	67.2 ± 10.6, 33–90	0.008	0.98 (0.94–1.02)	0.307
Men; n=285	44 (68.8%)	66 (77.6%)	109 (80.1%)	0.200	–	–
Scottish index of multiple deprivation score quintile; n = 283:						
1 or 2 (most deprived)	16 (25.0%)	14 (16.5%)	21 (15.7%)	0.133	–	–
3	16 (25.0%)	23 (27.1%)	52 (38.8%)		–	–
4 or 5 (least deprived)	32 (50.0%)	48 (56.5%)	61 (45.5%)		–	–
Scottish urban rural 6-fold classification; n = 281:						
Other urban area	15 (24.2%)	26 (30.6%)	31 (23.1%)	0.179	–	–
Remote small town	18 (29.0%)	15 (17.6%)	21 (15.7%)		–	–
Accessible rural	8 (12.9%)	8 (9.4%)	13 (9.7%)		–	–
Remote rural	21 (33.9%)	36 (42.4%)	69 (51.5%)		–	–
Working (full or part-time); n = 278	15 (23.4%)	24 (29.3%)	54 (40.9%)	0.033	1.20 (0.52–2.76)	0.672
Feelings of loneliness (sometimes or often); n = 279	32 (50.8%)	29 (34.5%)	44 (33.3%)	0.049	2.15 (0.94–4.88)	0.068
Home occupants; n = 281:						
Alone	22 (34.4%)	13 (15.5%)	26 (19.5%)	0.030	1.00	
Spouse/partner	38 (59.4%)	69 (82.1%)	102 (76.7%)		1.66 (0.49–5.66)	0.416
Other (family/friends/pets)	4 (6.3%)	2 (2.4%)	5 (3.8%)		0.53 (0.05–5.55)	0.598
Smoking; n = 282:						
Never	24 (37.5%)	38 (45.2%)	49 (36.6%)	0.015	1.00	
Ex-smoker	28 (43.8%)	43 (51.2%)	75 (56.0%)		1.45 (0.72–2.91)	0.294
Smoker	12 (18.8%)	3 (3.6%)	10 (7.5%)		0.71 (0.16–3.18)	0.657
Highest level of education; n = 280:						
School	34 (54.8%)	36 (42.9%)	56 (41.8%)	0.388	–	–
College	14 (22.6%)	28 (33.3%)	48 (35.8%)		–	–
University	14 (22.6%)	20 (23.8%)	30 (22.4%)		–	–
Access to transport:						
Car; n = 282	53 (82.8%)	79 (94.0%)	122 (91.0%)	0.067	0.80 (0.16–3.92)	0.779
Convenient public transport; n = 279	46 (74.2%)	66 (79.5%)	90 (67.2%)	0.132	–	–
Bicycle; n = 279	24 (38.7%)	38 (45.2%)	81 (60.9%)	0.006	0.91 (0.43–1.92)	0.801
Diagnosis; n=285:						
Non-ST elevation MI	22 (34.4%)	29 (34.1%)	42 (30.9%)	0.366	–	–
ST elevation MI	16 (25.0%)	15 (17.6%)	26 (19.1%)		–	–
Unstable angina	5 (7.8%)	9 (10.6%)	16 (11.8%)		–	–
Stable angina	10 (15.6%)	16 (18.8%)	38 (27.9%)		–	–
Other (HF, arrhythmia or structural cardiac disease)	11 (17.2%)	16 (18.8%)	14 (10.3%)		–	–
Management; n = 285:						
Medical	10 (15.6%)	15 (17.6%)	21 (15.4%)	0.220	–	–
Percutaneous coronary intervention	44 (68.8%)	52 (61.2%)	93 (68.4%)		–	–
Surgical	7 (10.9%)	16 (18.8%)	22 (16.2%)		–	–
Cardiac device	3 (4.7%)	2 (2.4%)	0 (0.0%)		–	–
Co-morbidities; n = 285:						
Number of co-morbidities, range	3.6 ± 2.4, 0–13	2.6 ± 1.7, 0–6	2.1 ± 1.5, 0–7	< 0.001	0.81 (0.64–1.02)	0.072
Cardiac rehabilitation attendance; n = 281:						
Previous attendance at cardiac rehabilitation before index event	8 (12.9%)	11 (12.9%)	12 (9.0%)	0.570	–	–
Cardiac rehabilitation attendance (index event); n = 274:						
None	39 (62.9%)	30 (37.5%)	59 (44.7%)	0.009	1.00	
All or some	23 (37.1%)	50 (62.5%)	73 (55.3%)		0.89 (0.42–1.87)	0.749
Quality of life:						
Index value (score range 0–1); n = 281	0.71 ± 0.26	0.86 ± 0.15	0.89 ± 0.15	< 0.001	2.06 (0.13–32.36)	0.606
EQ-VAS (score range 0–100); n = 280	64.28 ± 21.04	77.21 ± 15.37	81.35 ± 14.90	< 0.001	1.02 (0.99–1.05)	0.305
Psychological barriers to physical activity:						
Barriers to being active:						
Lack of time; n = 258	9 (17.3%)	9 (11.8%)	20 (15.4%)	0.662	–	–
Social influence; n = 263	13 (24.1%)	5 (6.3%)	7 (5.4%)	< 0.001	0.23 (0.05–1.18)	0.079

Lack of energy; n = 258	9 (18.0%)	11 (14.1%)	16 (12.3%)	0.614	–	–
Lack of willpower; n = 261	21 (40.4%)	26 (32.9%)	21 (16.2%)	0.001	**0.42 (0.18–0.97)**	**0.043**
Fear of injury; n = 265	10 (18.5%)	9 (11.5%)	9 (6.8%)	0.057	1.53 (0.36–6.44)	0.560
Lack of skill; n = 261	15 (28.3%)	8 (10.3%)	14 (10.8%)	0.004	1.32 (0.37–4.67)	0.670
Lack of resources; n = 265	8 (14.8%)	4 (5.1%)	10 (7.6%)	0.123	–	–
^Social support and exercise survey (score range 10–50); Wilks' Lambda = 0.898, [F (4,470) = 6.496], p < 0.001; n = 239						
Family participation	17.50 ± 9.78	23.54 ± 10.35	25.90 ± 11.67	< 0.001	1.00 (0.97–1.04)	0.972
Friend participation	14.48 ± 6.95	15.78 ± 7.27	19.19 ± 10.20	0.002	1.03 (0.98–1.08)	0.236
^Physical activity self-efficacy (score range 1–10); Wilks' Lambda = 0.833, [F (6,430) = 6.875], p < 0.001; n = 220						
Self-efficacy to overcome barriers	4.38 ± 2.39	5.22 ± 2.13	6.54 ± 2.14	< 0.001	**1.29 (1.05–1.59)**	**0.016**
Self-efficacy to complete activity	6.38 ± 2.47	7.55 ± 2.08	8.16 ± 1.57	< 0.001	1.10 (0.84–1.43)	0.483
Self-efficacy to schedule activity	4.98 ± 2.75	6.41 ± 2.31	7.00 ± 2.21	< 0.001	0.84 (0.67–1.06)	0.144
^Physical activity motivation (score range 0–4); Wilks' Lambda = 0.902, [F (6,538) = 4.749], p < 0.001; n = 274						
Amotivation	0.39 ± 0.70	0.33 ± 0.58	0.20 ± 0.54	0.081	0.99 (0.51–1.91)	0.977
External regulation	0.64 ± 1.10	0.75 ± 0.94	0.54 ± 0.82	0.260	–	–
Intrinsic regulation	2.28 ± 1.29	2.62 ± 1.10	3.08 ± 0.92	< 0.001	1.08 (0.69–1.69)	0.724

Chi-square and ANOVA tests used to analyse categorical and continuous data, respectively; n (percent)/mean ± standard deviation (SD) of complete data detailed for each variable row.

+Multivariate regression analysis based on complete data for 168 responders (24 low active, 57 moderately active and 87 high active). Univariate significance taken at 10% level ($p \leq 0.1$). Nagelkerke R^2 of adjusted model = 0.316, p = 0.001.

^Data analysed in 3 separate MANOVA tests

CI — confidence interval; HF — heart failure; MI — myocardial infarction