
Kathryn A. Murray¹,², David J. Murphy², Sarah-Jane Clements¹, Adrian Brown³, Susan B. Connolly¹

¹MyAction Westminster, Imperial College Healthcare NHS Trust, 5th Floor, Charing Cross Hospital, Fulham Palace Road, London W6 8RF, UK
²Department of Neuropsychology and Clinical Health Psychology, 10th Floor, Charing Cross Hospital, Fulham Palace Road, London W6 8RF, UK
³Public Health England, London, UK
Address correspondence to Kathryn A. Murray; E-mail: katie.murray2@nhs.net

ABSTRACT

Background Despite the benefits of cardiac rehabilitation, uptake and adherence remain suboptimal. With the advent of NHS Health Checks, primary prevention programmes have also been advocated, but little is known about uptake and adherence rates. This study examined rates and predictors of adherence amongst patients with cardiovascular disease (CVD) and those at high multifactorial risk (HRI) attending an innovative programme integrating primary and secondary prevention.

Methods Comparison of rates of uptake and adherence and also predictors of adherence between 401 CVD patients and 483 HRI. The outcome was the number of sessions attended and predictor variables included clinical and psychosocial variables. Differences between groups were examined using t-tests and non-parametric tests. Multivariable regression analyses examined predictors of adherence.

Results Uptake to the assessment (CVD: 97%, HRI: 88%) and the programme (CVD: 78%, HRI: 74%) were high for both groups. An average of 8/12 was attended in both groups. Beliefs about treatment predicted adherence for both groups (P<0.01). The alcohol causal belief also predicted poorer adherence amongst CVD patients (P<0.02). Older age also predicted better adherence amongst HRI (P<0.001).

Conclusions Rates of uptake and adherence were high for both HRI and CVD patients. Further research is needed to examine whether interventions targeting predictor variables further improve adherence.

Keywords beliefs, population-based and preventative services, psychological determinants

INTRODUCTION

There is good evidence that cardiac rehabilitation (CR) programmes can reduce the risk of all-cause and cardiac mortality in those with cardiovascular disease (CVD) by around 20 and 26%, respectively,¹ but a significant challenge has been the suboptimal uptake and adherence to such programmes.

Recent data from the National Audit of Cardiac Rehabilitation (NACR) indicate that only 44% of eligible patients in the UK participate in CR² and drop-out rates range from 30 to 50%.³ A large body of research has examined reasons for poor uptake at CR and a range of barriers have been identified, including service-related factors, e.g. limited programme capacity and patient-related factors, e.g. being older, female and having comorbidities.⁴–⁶ Psychological barriers are also important and include depression, anxiety,
lack of social support and illness beliefs. A recent systematic review amongst patients following MI concluded that beliefs about controllability, consequences and having a good understanding of the illness are predictive of better attendance to CR.

More recently, the Government White Paper put ‘prevention first’ because there is strong evidence that a healthy lifestyle, control of other risk factors and cardioprotective medications can substantially reduce CVD. In 2012 over 1.1 million health checks were carried out in England and Wales, resulting in a large number of individuals being identified at high cardiovascular risk (HRI). Primary prevention programmes that target these HRI are substantially less well established than CR programmes and consequently there is a relative paucity of data on uptake and adherence to such programmes. The few limited studies in this area, however, suggest that uptake is lower in primary relative to secondary prevention programmes. This is not unexpected as individuals attending primary prevention programmes have not yet experienced a life-threatening event and are likely to hold different health beliefs to those who have. As the Health Checks programme grows exponentially there is a pressing need to better understand rates of uptake and adherence to primary prevention programmes and also to identify the key determinants of adherence to such programmes.

The integration of primary and secondary preventive care, ‘i.e. managing CVD as a single family of disease’ has recently been recommended as a key component of the new CVD outcomes strategy [www.gov.uk/government/uploads/system/uploads/attachment_data/file/217118/9387-2900853-CVD-Outcomes_web1.pdf]. MyAction Westminster is an innovative cardiovascular prevention programme, which integrates the care of patients with CVD and HRI in a community setting and has been running for 4 years. It is based upon the principles of the Euroaction study and has shown to be feasible and effective in an NHS setting. The MyAction model is unique in the UK and thus provides a rapid assessment of atherosclerotic disease and the HRI group was of those aged between 40 and 74 years identified as at high multifactorial risk through an NHS Health Check. For both groups, the exclusion criteria were severe health problems.

METHODS

Design

Retrospective analysis of rates of uptake, adherence and predictor variables were analysed within and between two groups of HRI and CVD patients who attended the MyAction programme.

Sample

The sample consisted of consecutive referrals to the MyAction programme between July 2009 and November 2011. The CVD group consisted of patients presenting with any manifestation of atherosclerotic disease and the HRI group was of those aged between 40 and 74 years identified as at high multifactorial risk through an NHS Health Check. For both groups, the exclusion criteria were severe health problems.

Measures

Uptake rate was defined as attendance at the initial assessment (IA). As the number of sessions offered varied according to individual patient need, drop-out was defined according to whether an individual patient’s planned programme was completed or not. Early drop-out, after attending the first two sessions, was also measured. Adherence to the programme was assessed by examining electronic records of the number of exercise classes attended by each participant.

Demographic, clinical and psychosocial variables were collected from a battery of questionnaires completed at the IA appointment. Psychological distress was assessed using the hospital anxiety and depression scale (HADS), which has been widely used with cardiac and non-clinical samples. A cut-off score of >8 was used to identify mild/moderate symptoms. Health-related quality of life (HRQoL) was assessed with the EuroQol Group 5-Dimension Self-Report Questionnaire score (EQ5D) and the EuroQol Visual Analogue Scale of current health status (EQVAS). Other measures obtained at baseline included clinical diagnosis, demographic data, lifestyle and medical risk factors.

Illness perceptions among CVD patients were measured using a slightly modified version of the Brief Illness Perceptions Questionnaire. The Brief IPQ has been validated with cardiac patients and provides a rapid assessment of illness perceptions across eight components: consequences, coherence, personal control, treatment control, identity, concern, emotions and timeline, as well as questions assessing beliefs about the cause of the illness. Fixed choice responses assessing degree of agreement with causes commonly associated with heart disease were included as follows: diet, smoking, alcohol, stress, hereditary factors and bad luck.
Since high-risk patients did not have a diagnosed illness the Brief IPQ was slightly modified to change beliefs about ‘cause’ of CVD to beliefs about ‘risk’ of developing CVD. For example, ‘I am worried that I may develop heart disease; I believe that quitting smoking will reduce my risk of developing heart disease’.

Analysis
Baseline differences between the CVD patients and HRI were examined. The unpaired $t$-test was used to compare continuous variables with a normal distribution, the Mann–Whitney test was used for variables without a normal distribution and the chi-square test was used to compare categorical variables.

Separate linear regression analyses were conducted to examine predictors of adherence for the whole sample and subsequently within the CVD and HRI groups. Linear regression analyses were used to examine the separate effects of each variable on the number of sessions attended. For the categorical explanatory variables, the regression coefficients represented the difference in the number of sessions attended between each group and a baseline category. For the continuous variables, the coefficients represented a difference in the number of sessions for a given increase in each variable. Multivariable analyses, using a backward selection procedure were then conducted to retain only the statistically significant variables in the model.

RESULTS
Baseline characteristics of programme participants
Full data regarding the number of sessions attended was available for 884 participants. The mean age of the participating sample was 64 years (SD 11.4) and 531 (60%) of the participants were men. The baseline characteristics of the two groups are presented in Table 1. For the categorical variables, the number and percentage within each category are given and for the continuous variables, the mean and standard deviation are given.

Uptake and adherence to the programme
Referral and uptake rates to the IA, exercise sessions (ES), home exercise programmes and individual sessions (IS) are shown in Fig. 1.

Overall 25% (223/884) of participants completed all 12 sessions and the mean number of sessions attended was 7.7 (SD 6) with no significant differences between the groups (CVD = 7.3, SD 5.7; HRI = 7.7, SD 6.2). The drop-out rate was 19% for both groups and early drop-out (after the second session) was 13% for CVD patients and 12% for HRI. After the second session, attendance was normally distributed around the mean. There were no significant differences between those who completed the programme and those who dropped out according to education, employment,
ethnicity and gender. The mean age of completers (67 years) was significantly higher than the mean age of drop-outs (63 years, \( P < 0.001 \)).

**Predictors of adherence for all patients**

When each factor was examined in separate linear regression analyses, age \( (B = 0.9, \text{CI} = 0.5, 1.0, P < 0.01) \), anxiety \( (B = -1.8, \text{CI} = -2.8, -0.8, P < 0.001) \), depression \( (B = -1.3, \text{CI} = -2.3, -0.3, P < 0.02) \) and HRQoL \( (B = 0.3, \text{CI} = 0.1, 0.4, P < 0.001) \) had a significant effect on the number of sessions attended.

When the variables were entered into a multivariable analysis, only age \( (B = 0.9, \text{CI} = 0.3, 1.2, P < 0.002) \) and HRQoL \( (B = 0.24, \text{CI} = 0.1, 0.4, P < 0.04) \) remained significant predictors of adherence. A higher age by 10 years was associated with attending 0.9 sessions more sessions. A 0.1 higher HRQoL score was associated with attending 0.2 more sessions.

**Predictor variables for cardiovascular patients**

The same set of predictor variables, with the addition of illness perception scores, was then examined separately for the CVD group. In the univariable analyses, anxiety, HRQoL and three illness beliefs were found to be associated with attendance rates. The regression coefficients and their corresponding confidence intervals are shown in Table 2.

When entered into a multivariable analysis, two beliefs about heart disease emerged as the strongest predictors of attendance. Those who believed that treatment could control their illness attended almost three more sessions that those...
A similar analysis was conducted to predict attendance in high-risk individuals. Predictors of adherence for both groups were also identified. In the CVD group, predictors included age, depression, and having a major consequence related to one’s life. In contrast, for HRI, predictors included age, anxiety, depression, and the belief that treatment can control one’s illness. These findings suggest that targeting these beliefs in interventions may be effective in promoting adherence.

**DISCUSSION**

Main findings of this study

Uptake and adherence rates were relatively high for both CVD patients and HRI attending an innovative primary and secondary prevention programme. Uptake to the IA was excellent at 97% for CVD patients and 88% for HRI. Uptake to the subsequent programme was 64%, although higher (78% for CVD patients and 74% for HRI) when excluding the missing data and examining the available adherence data only. Of these, ~63% attended the core weekly classes in both groups, with the remainder attending individual or home programmes. Previous studies have indicated uptake rates of up to 41% amongst patients referred to outpatient CR and uptake rates to health checks range from 20 to 44%.

Adherence to the programme was also good with an average of 8/12 sessions being attended. The drop-out rate of 19% for both groups was also comparatively low as the average range from 30 to 50% for CR.

There were several differences between the CVD and HRI groups at baseline. There were significantly more patients with elevated depression scores and the mean HRQoL scores were lower in the CVD group. There were also more men in the CVD group and the mean age was higher, which is consistent with data indicating that more men experience cardiac events than women and CVD disease increases with age.

Another baseline difference was fewer smokers in the CVD group which is to be expected as ~1/2 of those who smoke prior to having a cardiovascular event will quit after their event.

There were common and unique predictors of adherence in the two groups. Beliefs about treatment emerged as significant predictors of adherence for both groups. The belief that attending regular medical appointments would reduce CVD risk predicted adherence for HRI. However, it should be noted that the wide confidence interval for this result reflects the small number of observations for disagreement with this belief; therefore, this result should be interpreted with caution until replicated with a larger sample. Nonetheless, this finding suggests that those who believed treatment could reduce their CVD risk attended more sessions. Similarly, within the CVD group, those who believed that treatment could control their illness were more likely to attend subsequent sessions.

When entered in a multivariable analysis, older age (B = 1.9, CI = 1.0, 2.7, P < 0.001) and the belief that attending regular medical appointments would reduce CVD risk (B = 7.5, CI = 1.7, 13.3, P < 0.01) remained significant predictors of the number of ESs attended. A higher age by 10 years was associated with attending 1.9 more sessions, and the belief that attending medical appointments would reduce heart disease risk was associated with attending 7.5 more sessions.

**Table 2** Regression coefficients, confidence intervals and P-values from linear regression analyses of predictors of attendance for CVD patients.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Coefficient (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>&gt;8</td>
<td>-2.0 (-3.4, -0.7)</td>
<td>0.003</td>
</tr>
<tr>
<td>My illness was caused by smoking</td>
<td>Agree</td>
<td>-2.2 (-3.9, -0.4)</td>
<td>0.02</td>
</tr>
<tr>
<td>My illness was caused by alcohol</td>
<td>Agree</td>
<td>-2.8 (-5.4, -0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>My illness has major consequences on my life</td>
<td>Neutral</td>
<td>-2.6 (-5.2, -0.6)</td>
<td>0.05</td>
</tr>
<tr>
<td>EQ5D HRQoL&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>0.2 (0.01, 0.4)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

<sup>a</sup>Coefficients reported for a 0.1-unit increase in the EQ5D score.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Coefficient (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age&lt;sup&gt;b&lt;/sup&gt;</td>
<td>–</td>
<td>1.7 (1.1, 2.3)</td>
<td>0.001</td>
</tr>
<tr>
<td>EQ5D&lt;sup&gt;b&lt;/sup&gt;</td>
<td>–</td>
<td>0.3 (0.04, 0.5)</td>
<td>0.02</td>
</tr>
<tr>
<td>Anxiety</td>
<td>&gt;8</td>
<td>-1.5 (-2.9, -0.2)</td>
<td>0.03</td>
</tr>
<tr>
<td>Depression</td>
<td>&gt;8</td>
<td>-1.6 (-3.1, -0.1)</td>
<td>0.04</td>
</tr>
<tr>
<td>Attending regular appointments</td>
<td>Agree</td>
<td>6.1 (0.8, 11.4)</td>
<td>0.03</td>
</tr>
<tr>
<td>Becoming more active</td>
<td>Agree</td>
<td>7.7 (0.8, 14.7)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

<sup>a</sup>Coefficients reported for a 0.1-unit increase in the explanatory variable.
<sup>b</sup>Coefficients reported for a 0.1-unit increase in the explanatory variable.

who did not (B = 2.9, CI = 0.8, 5.0, P < 0.01). Those who believed that their illness was caused by alcohol attended three fewer sessions than those who did not (B = -3.1, CI = -5.7, -0.5, P < 0.02).

A t-test was then carried out to compare the mean units of alcohol consumed between those who agreed and disagreed with the alcohol causal belief. Those who believed alcohol was the main cause consumed, on average, over twice as many units of alcohol than those who did not (mean = 18.3, SD 25.9 versus mean = 7.97, SD 13.2 P < 0.003).
illness attended more sessions. These findings are consistent with a systematic review examining the effects of illness beliefs on attendance at CR which found that control beliefs were the most significant predictors of attendance. Another study proposed that beliefs about treatment are more predictive of treatment uptake than are beliefs about illness per se. Within the CVD group, the second predictor of adherence was the belief that alcohol was the primary cause of the illness. Beliefs about treatment are closely related to beliefs about the cause of an illness. Patients who do not have a good understanding of the causes of CVD are less likely to see the relevance of an exercise programme. Although alcohol consumption was not an independent predictor of adherence, not surprisingly, there was an association between consumption and this belief. Those who believed that alcohol was the main cause of their illness consumed significantly more units per week than those who disagreed with this belief. Patients who drank excessive alcohol may have viewed exercise classes as less relevant. Indeed, a recent qualitative study found that some patients do view CR as unnecessary or inappropriate and these beliefs are underpinned by a lack of understanding of the role of physical activity and misconceptions about causal factors of heart disease.

Age emerged as the most reliable predictor of adherence for HRI, with older patients attending more sessions. Whilst there is inconsistency in the literature regarding the effects of age on adherence to CR, some studies have found that younger patients are less likely to complete CR due to less provision of CR outside of working hours. Interestingly, age was not a significant predictor of adherence for the CVD group in this study. A possible explanation is that the CVD patients of working age were more likely to have accessed sick leave from work, and therefore age did not significantly affect attendance in this group.

Of note, some variables that have previously been found to predict attendance at cardiac rehabilitation did not independently do so in the present study, namely anxiety, depression, gender and ethnicity. The finding that ethnicity did not affect adherence is reassuring, given that one of MyAction Westminster’s key aims is to engage minority ethnic groups. Recent data from the NACR also found that there have been improvements in the engagement of ethnic minority groups to CR. Although several studies have found that women are underrepresented in CR, a recent review found inconsistencies in the studies. Another study found that it was not gender per se that led to poorer adherence, but rather a number of other factors more prevalent in these women, such as depression and lower use of cardiac medication.

One possible reason why this study did not replicate the finding that anxiety and depression predict adherence to CR is that the majority of previous studies have examined predictors of attendance versus non-attendance, whereas this study examined predictors of adherence, in terms of the total number of sessions attended. Higher levels of anxiety and depression may be barriers to initial uptake, but have less effect on the overall adherence rates.

**What is already known on this topic**

It is well known that uptake and adherence to CR are suboptimal. A range of barriers, including certain illness beliefs, have been identified but there are inconsistencies in the findings. More recently, primary prevention programmes have been advocated but little is known about uptake and adherence to such programmes or factors affecting adherence.

A few studies have explored interventions to modify unhelpful illness beliefs, but there is limited evidence that changing them increases attendance at CR. An intervention targeting beliefs about treatment, however, led to more promising outcomes.

**What this study adds**

To our knowledge, this is the first study to compare rates of uptake and adherence in primary and secondary prevention patients and also to examine predictors of adherence in both these populations. This study demonstrated relatively high rates of uptake and adherence for both HRI and CVD patients. The high uptake rates for HRI are particularly promising given that these individuals are asymptomatic. The findings suggest that beliefs about treatment are predictors of adherence for both populations. Older age also predicted adherence for HRI but not for the CVD patients and the belief that the illness was caused by alcohol also predicted adherence for the CVD patients but not for HRI.

These findings could be used to guide research examining whether interventions targeting beliefs about treatment in turn enhance retention rates to primary and secondary prevention programmes. Within secondary prevention, education about the multiple risk factors, in addition to alcohol, that cause heart disease may lead to a better understanding of the relevance of a multi-component exercise programme. Within primary prevention, interventions targeting younger individuals, such as offering more classes outside of working hours, may also improve adherence.

**Limitations**

The main limitation in this study was missing data. Data regarding the number of ESs attended was missing for 10% of participants. Data regarding the number of patients who declined to attend the programme at the referral stage was unavailable. Furthermore, data regarding adherence to alternative interventions (home programme and ISs) was not...
examined. Future research should examine adherence to all components of the programme, where possible.

Another limitation was the small number of observations for disagreement with the belief that attending medical appointments will reduce CVD risk. As this was a binary variable, the limited distribution led to a large confidence interval. Further research with a larger sample is therefore needed to increase the reliability of this finding.

Acknowledgements

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References